FLYING

JULY
1944
35c
In Canada 40c

After Victory many more Americans will be saying "Buenos Dias, Vecino" and "Bom Dia, Meu Vizinho"

Yes, we'll be saying, "Good Morning, Neighbor," to our Spanish and Portuguese speaking friends in South America, a lot more often—after Victory.

Then, improved aircraft and a vastly expanded network of airlines, will bring the Americas so close together that trips may be measured in hours—rather than days.

St. Louis to Sao Paulo, Rochester to Rio, Boston to Buenos Aires, Birmingham to Bogota, St. Paul to Santiago—such trips will become almost as commonplace as a St. Louis to New Orleans flight today.

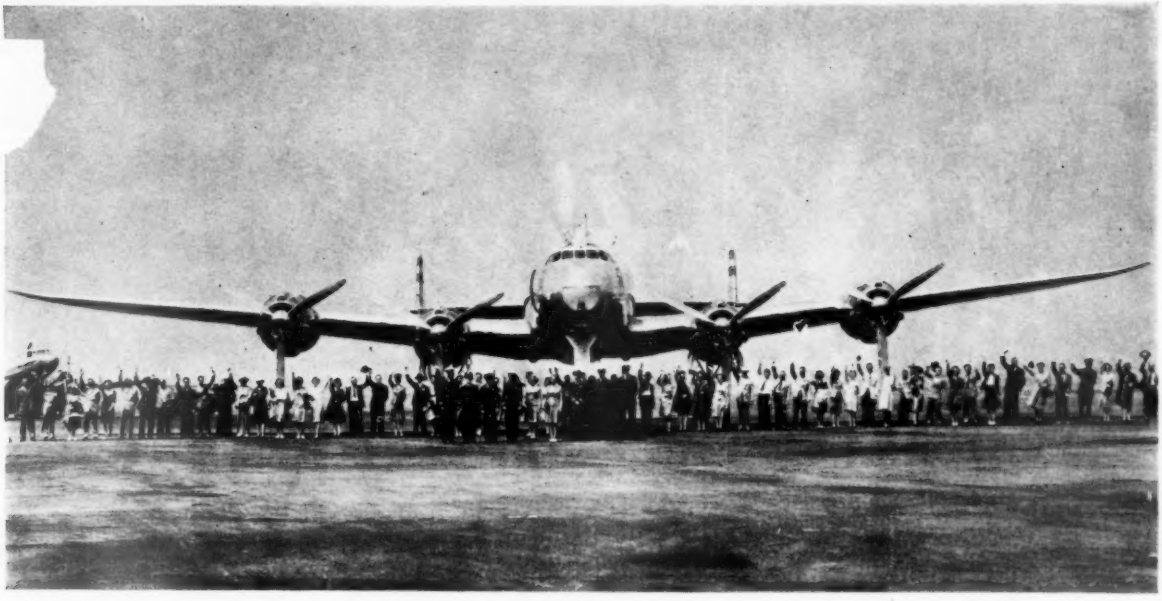
Right now, of course, production for war comes first. That's why, at McDonnell, we're working three shifts a day, making planes, parts, and plastics for America's Armed Forces.

But we're making plans even now to supply the type of aircraft which will help South Americans to a quicker realization of the rich future which is theirs. Yes, after Victory, McDonnell too, expects to be saying, "Buenos Dias, Vecino."

McDONNELL *Aircraft Corporation*

Manufacturers of PLANES · PARTS · PLASTICS ★ SAINT LOUIS-MEMPHIS ★

Another Example of Parks Leadership Training—



FLIGHT ENGINEER ON CONSTELLATION'S RECORD-BREAKING CROSS-COUNTRY FLIGHT A PARKS AIR COLLEGE GRADUATE

As Lockheed's Constellation made aviation history with its record-breaking 6-hour and 58-minute cross-country flight, another Parks graduate proved the value of the Leadership training available to you at Parks Air College. The Flight Engineer on that historic flight received his training at Parks Air College.

For the past 17 years, Parks Air College has been preparing men like yourself to attain positions of Leadership in the Aviation industry as has this Flight Engineer. Parks graduates continue to fill positions of responsibility in the expanding aviation industry.

Because of the thoroughness of its training courses, Parks Air College has long been recognized by the aviation industry as a leader in the aviation field. Original approval of Parks by the U. S. Department of Commerce dates back to 1929.

Parks offers you a college education leading to a B. S. Degree in each of its three courses — Aviation Operations Engineering, Aviation Maintenance Engineering, Aeronautical Engineering. Your training at Parks will mean to you, as it has to the Constellation's Flight Engineer and other Parks graduates, a future of Leadership in aviation.

Parks 64-page catalog describes in detail the training for aviation leadership available at Parks Air College. Send for it today.

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Please send me the Parks 64-page catalog giving complete details of the courses offered in commercial aviation training.

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City.....Zone....State.....

Enrollment limited to Male Students.
Summer Term begins July 10, 1944.

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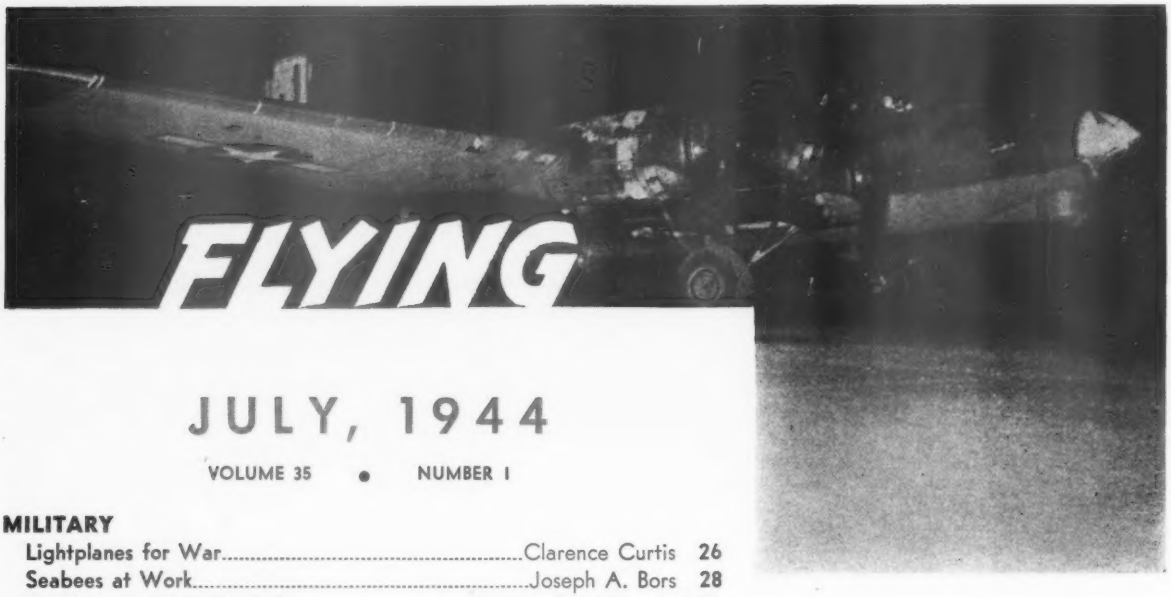

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5. *By extending Goodyear Research facilities to aid the solution of any design or engineering problem.*

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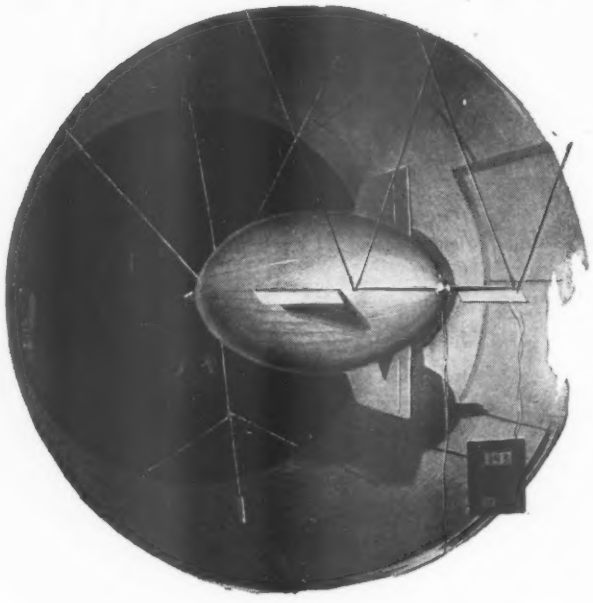
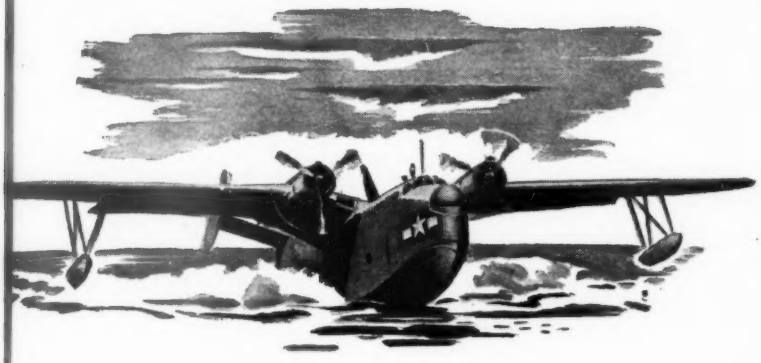


GUST EFFECTS ON AIRSHIPS were extensively studied and tested by Goodyear and the Navy long before their importance in building heavier-than-air craft became evident. Special wind tunnel equipment was initiated to simulate, upon scale-model airships, the aerodynamic forces created by gusts of varying intensity. These tests provided the basis for computing stresses resulting from gust disturbances on ships in flight. This long and tedious research contributed importantly to present-day knowledge of the effects of atmospheric disturbances on aircraft —increasingly important today as larger airplanes are being built. This is another example of the breadth of Goodyear's background in aircraft development.

BUILDING PROVEN AIRCRAFT PARTS



THE FAR-RANGING MARTIN PBM-3 is another of America's dependable planes built in part by Goodyear Aircraft. Large numbers of these long-distance patrol bombers now in service are equipped with ailerons, flaps and empennages fabricated by Goodyear. In building components for the PBM-3 and other famous aircraft Goodyear has the advantage of its long experience and extensive research in all branches of aeronautics — a background that goes back to the very early days of aeronautics. This time-proved skill is further attested by Goodyear's standout record in building complete aircraft, including both the superb Corsair fighter and naval patrol airships.

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America's fighter pilots using Allison-powered planes are downing the enemy on every battle front. ★ Allison engines by superb performance have proved their ability to take punishment, their smoothness to lessen pilot fatigue, their economy to provide long range. ★ These engines — worthy weapons today — will contribute to the comfort and safety of the planes you will ride in tomorrow.

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More than 50,000 Allison engines have been built for the above planes of the U. S. Army Air Forces.

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The GENERAL DEFLECT-O-GAUGE

Determines correct operating deflection for any aircraft tire...without graphs, charts, scales, air pressure gauges... in just 60 seconds!

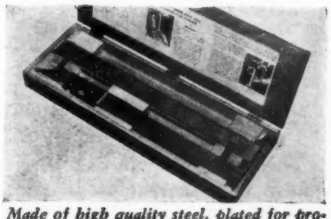
{Above} Taking undeflected reading at top of airplane tire

{Right} Taking deflected reading at bottom of airplane tire

Rigid tests show here is the first scientific way to prevent premature tire failures from improper inflation

An exclusive development by General Tire's aviation engineers . . . the General Deflect-O-Gauge has been tested on all types of aircraft tires. *Every time* it has proved that with it each tire can be inflated to *exactly* the correct pressure for the load . . . and this pressure can be determined in just 60 seconds!

Thus, General Tire has initiated a new era of accuracy in aircraft maintenance . . . gives you a positive way to increase the service life of your aircraft tires . . . and save precious rubber.



Made of high quality steel, plated for protection . . . easily read calibrations . . . spirit level on base assures correct readings. Assembled in 10 seconds. Packed in sturdy, attractive wooden case.

Available . . . without charge or obligation . . . is an informative instruction booklet on the General Deflect-O-Gauge. Learn for yourself the complete details of how the Deflect-O-Gauge *solves* aircraft tire pressure problems. Just write, ***Department 1,***

AVIATION DIVISION • THE GENERAL TIRE & RUBBER COMPANY, AKRON, OHIO

The Birdmen's Perch

LAST MONTH we announced a new department.

We named it, with simple dignity, "The Little Known Facts About Well Known Planes Dept." And we invited contributions. We even offered commissions as Perch Pilot (bottom rung) for same. We're repeating all this just in case you got in late.

Meanwhile, until your mail gets here, we have to rely on Flutter, the Canary Commando, for Little Known F.A.W.K.P. To wit . . .

Now they're using Cubs on carriers! They carry mail, messages (from carrier to carrier on radio-silenced convoys), and even laundry . . . ship to shore and vice versa!

The B-26, once called "too hot to fly" (and a lot of other balderdash), has had probably the lowest casualty rate in the ETO—½ of 1%!

A B-17 has made recon photos of wartime Japan, so maybe it won't be long now . . .

Major Al Williams,

alias "Tattered Wing Tips," Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh 30 Pa.

LET'S GET DOWN TO EARTH...

Most of you instructors, mechanics, CA-People, etc. are doing work that really matters.

And practically all of you use cars getting to and from that work. So why don't you join Gulf's "Anti-Breakdown" Club, today?

The way you do that is to call your Gulf dealer and make an appointment to get *Gulf's Protective Maintenance Plan* . . . 15 services in all! This group of services includes lubrication, oil change, tire inspection (or recapping), air-filter cleaning, spark-plug cleaning, radiator flushing.

The Gulf Protective Maintenance Plan was conceived by automotive experts. Gulf developed it because car maintenance is our most important civilian job. And we're telling you about it because Perch readers are doing some of our most important war work.

TECHNICAL DEVELOPMENTS

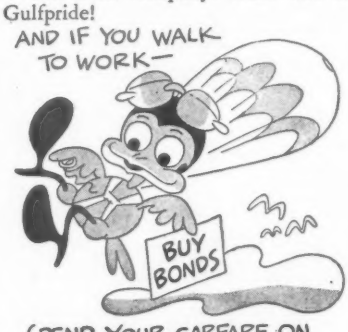
Here's what one company did:

They figured out a way to bond pure aluminum to steel. Then they bonded pure aluminum cooling fins (lightweight and excellent conductors of heat) and steel (for strength) cylinders. And now this particular company's 12-cylinder engine produces more horsepower per pound of weight than any comparable engine.

Here's what another company did:

They figured out a way to *break* the bond between a lubricating oil and those parts of it which quickly form carbon and sludge. Their method, which they called the Alchlor Process, makes it possible to get more of these carbon-makers and sludge-formers out of a lubricant. And now, this company's oil produces more lubrication per pound of oil than inferior lubricants.

This latter company: Gulf. The oil: Gulfpride!



Gulf Oil Corporation and Gulf Refining Company...makers of

GULF AVIATION PRODUCTS

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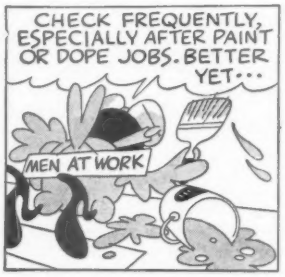

When we think of the unmatched courage of our flyers and air-borne troops . . . and the daily risks they take in behalf of all the people . . . the obvious moral of the story is . . .

BUY MORE WAR BONDS

"Thanks, Pal!"

Another Yank lands safe and sound on good old Mother Earth. And another Standard Parachute has done its great job . . . saving a precious flyer on his last chance. A "pal" indeed . . . for because of that chute he lives to fight on.

No other needlework assignment in all the world calls for such fine character of workmanship and precision of machines as the making of his parachute. It is a wartime necessity we fulfill with utmost pride. After Victory these same skills will be applied to Stanpar peace goods for better living.

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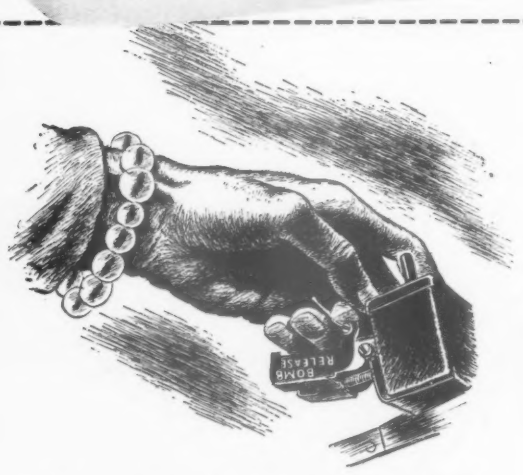
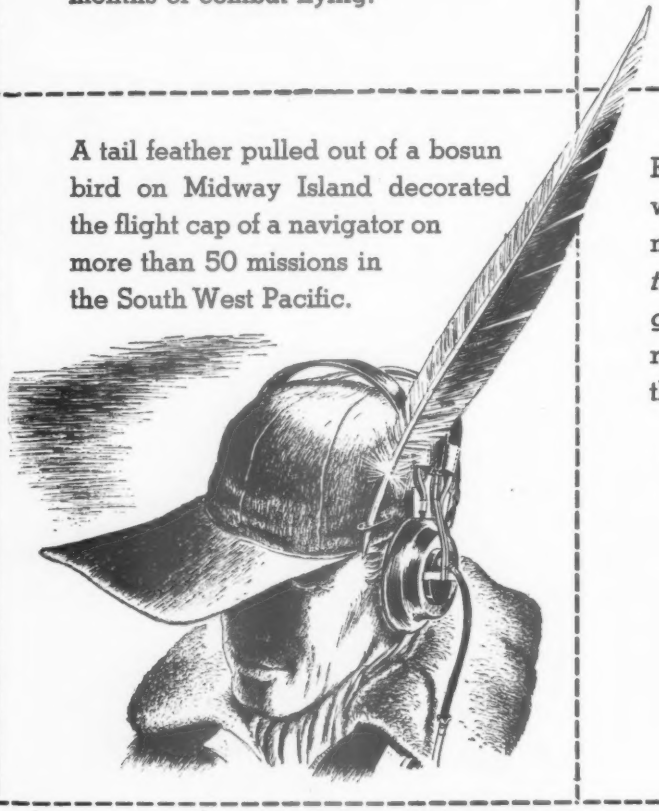


A bracelet of cat's-eye stones collected from a South Sea lagoon, hung around the "dropping" hand of a bombardier through twenty months of combat flying.

On every mission a sentimental farm boy, now a tail gunner, carried a small sack of the good earth from the farm back home.

A tail feather pulled out of a bosun bird on Midway Island decorated the flight cap of a navigator on more than 50 missions in the South West Pacific.



Ethyl antiknock fluid goes along with fighting planes powered by U.S. made gasoline. *It goes into practically every gallon of fighting grade aviation fuel*—which is one reason why our fliers not only have the best gasoline but plenty of it.

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TORONTO

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The enemy is listening and he hears well.

So the enemy *is* listening!

Not even the "superman" of the "master" race can hear the gliders . . . the gliders that settle silently in the darkness . . . the gliders that land their tough, airborne infantrymen and weapons far behind the lines.

That's why the enemy stirs uneasily behind the walls of his beleaguered fortress . . . watching with a million eyes . . . listening with a million ears. But never knowing—never, until the walls are breached. THE WACO AIRCRAFT COMPANY, Troy, Ohio, U.S.A.

WACO's wartime job is designing and building gliders for the Army Air Forces . . . and providing engineering supervision for the eleven other companies which are manufacturing gliders according to WACO plans and specifications. WACO's peacetime job, as in the past, will be building better planes for better flying.

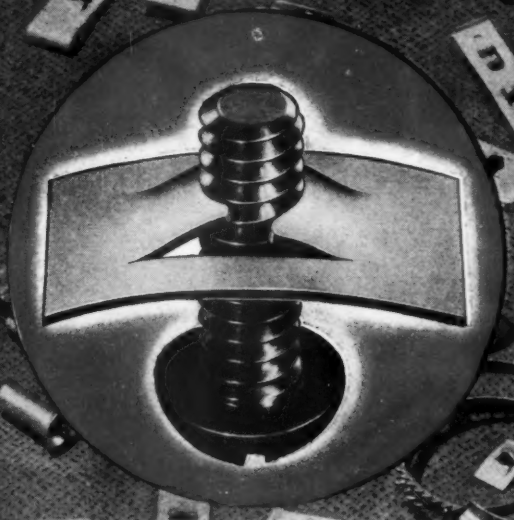
Waco

WACO AIRPLANES

ALL ARMY CARGO-TRANSPORT GLIDERS ARE WACO DESIGNED

Over 2000 Assembly Short Cuts

With Speed Nuts*



The SPEED NUT System of spring-tension fasteners comprises more than 2000 shapes and sizes. Back of each and every design was a new reason, hence a new method to improve specific assembly jobs.

In some cases, certain parts are completely eliminated. In other cases riveting operations or drilling of holes is dispensed with. Many SPEED NUTS hold themselves in screw-receiving position. Dismantling of parts for service or repair is often made twice as easy. And in every case, weight is reduced from 50% to 70%, time is generally cut in half and net assembly costs hit a new low.

Hundreds of metal, wood, and plastic products have already been fastened better in over 2000 ways with SPEED NUTS. Use more of them to fullest advantage now. If in doubt on correct shape, send blueprints for quick help.

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Fastest Thing in Fastenings

HOW YOU CAN USE YOUR POST-WAR PLANE

Doctor?

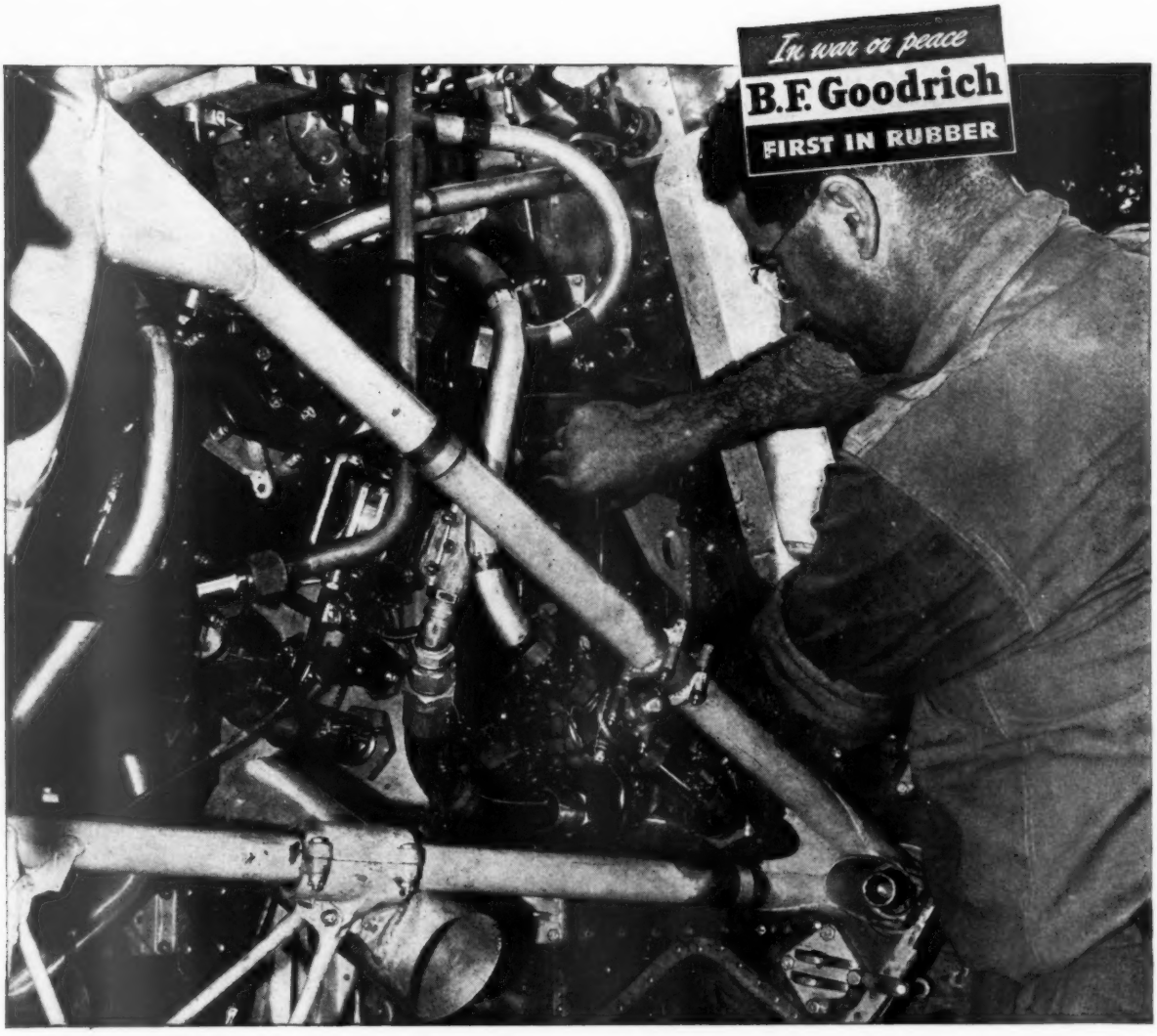
THE time's not far distant when a personal plane can become an invaluable aid to a doctor. Particularly in country regions, where a physician's practice may be spread over hundreds of square miles, might a plane contribute to saving of life and speedier care of the sick.

Given adequate landing facilities for improved models of conventional planes, or perfected helicopters, there will be hardly a family in America which cannot make practical, everyday use of a personal aircraft after the war is won.

Already, the engines to power those planes-to-come —smoother, more efficient, completely dependable, FRANKLIN engines—are being planned by Aircooled Motors Corporation engineers. Specify FRANKLIN power for *your* post-war personal plane.

Franklin
FINE AIRCRAFT ENGINES

AIRCOOLED MOTORS CORP.
Syracuse 8, N. Y.



Streams of oil make muscles for airplanes

A typical example of B. F. Goodrich development in rubber

SOME airplanes are so big it takes hundreds of pounds of pressure to move the wing flaps, landing gear and brakes. It's done by hydraulic systems, in which the power flows through streams of oil in pipe and hose. But if the hose is shot or damaged, the control won't work and men's lives may be endangered. Attaching couplings to new hose took giant presses, and they can't have those on every jungle airport.

Then, new couplings were developed which could be attached in the field. But the couplings wouldn't work. The rubber in the hose would stretch or "flow" when squeezed between the parts of the coupling — then sudden pressure in the hose would loosen the coupling.

B. F. Goodrich engineers were asked for a hose to make these couplings practical. They designed a hose that had no layers of rubber outside or between the cord layers. Instead they forced the protecting rubber down into the fibers of the cord as it was braided around the inner tube. There was no free rubber to "flow" — the jaws of the coupling bit into hard rubberized cords only, and held.

This new hose was the first cotton braided hose ever made that would stand the high pressures — as strong as wire braided hose formerly used, and much lighter. It's already on thousands of planes — another case where a B. F. Goodrich development has made some other development practical. *The B. F. Goodrich Co., Aeronautical Division, Akron, Ohio.*

B.F. Goodrich

OVER 80 RUBBER AND SYNTHETIC RUBBER PRODUCTS FOR AIRPLANES

NOTE TO SERVICE MEN AND WOMEN . . . . .

Beechcrafters are Grand People

Their slogan is "Let's Kill 'Em with Production," and our production lines have met schedules accurately for more than two years . . . They put not ten but more than *twenty* percent of their total pay into War Bonds . . . They have made heavy contributions of cash and effort to organizations and projects of benefit to Service men and women . . . Thousands of them have volunteered or cheerfully accepted induction into the Armed Services.

At a recent "Open House" showing of the Beech plants to Beechcrafters and their friends, more than 62,000 people made the inspection tour in one day. Their self-respect and their high appreciation of the courtesy due to others eliminated even the smallest infraction of the rules. The plants were as clean and free of litter at the end of the day as at the beginning.

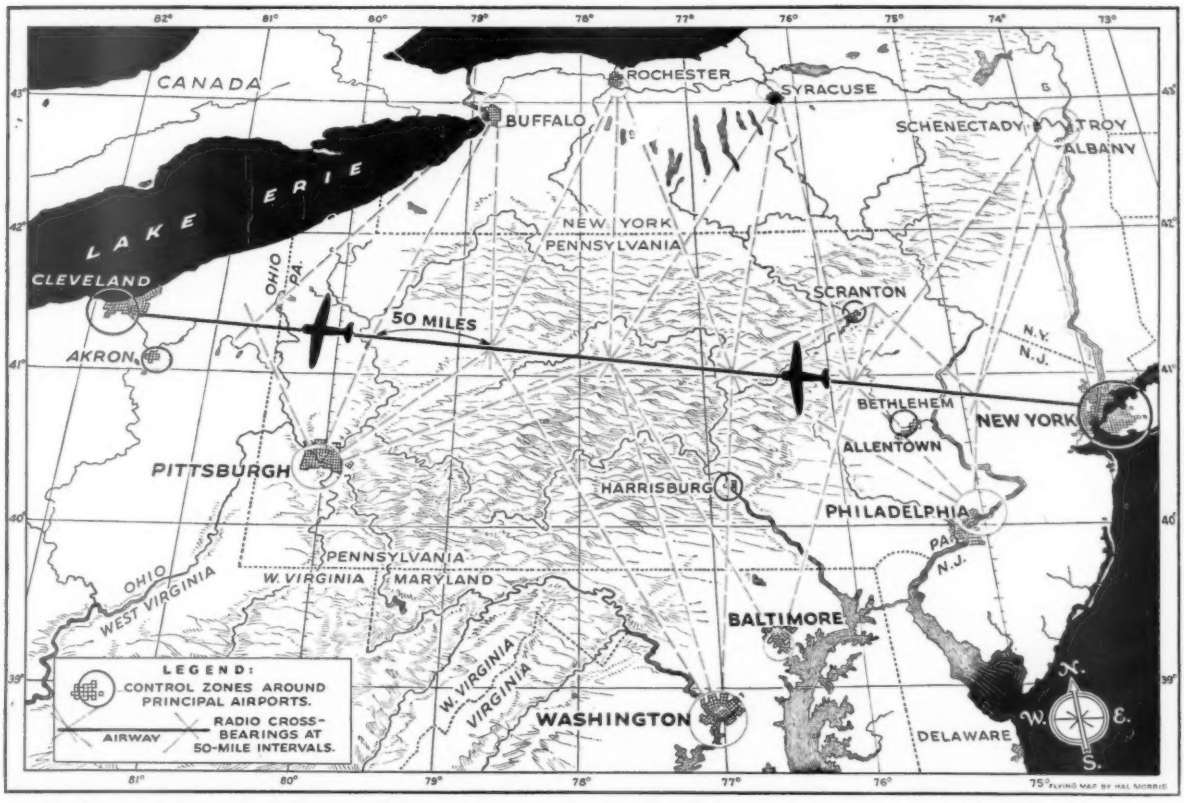
They are behind you with an eager spirit to do anything that will bring Victory even a minute sooner. They are your kind of folks.

Beech Aircraft CORPORATION

BEECHCRAFTS ARE DOING THEIR PART WICHITA, KANSAS, U. S. A.

Beechcrafters and Their Families at the Open House

SKY HIGHWAYS?



This is a typical New York-Cleveland flight, using automatic radio direction finder cross bearings on commercial broadcast stations only. No aviation radio aids are included here; by adding them the number of possible bearings is greatly increased

By DAVID E. POSTLE

CAB Member, U.S. Interdepartmental Air Traffic Control Board

A Government expert, in this exclusive article, offers a solution to the coming air traffic jam.

COMMONLY acknowledged by military and civil pilots throughout the United States is the distressing fact that our present system of civil airways and method of air traffic control is not an adequate solution to air traffic problems. The fault lies with the system and not with the operation, which is ably performed by the trained personnel of the Civil Aeronautics Administration. It is vital, therefore, that we plan now for the great expansion of airline operation after the war and organize an air traffic control system able to safeguard the 500,000 private airplanes which the Administrator of the CAA recently estimated would be flying by 1950.

The solution to this air traffic problem does not appear to be additional Federal airways nor any enlargements of the present system, which would require an expenditure of many millions of dollars. Rather than perpetuate the present system, a new method must be developed.

There is a solution to the problem. It is so simple that some may consider it revolutionary. It is within our grasp even now if we are not afraid to change our conception of civil airways and our method of air traffic control.

Why should we lay out specific but invisible highways across the free open sky over America? Why should we so stultify the freedom of flight that we must follow airways across the continent which are not direct as the bird flies but hop from one city to another in a jagged, indirect line? The maze of interlacing airways which now mark out the aerial highways over the United States served a necessary purpose in the initial development of our present air transportation system. Nevertheless the time has come when, if we are to successfully meet the challenge of increased traffic, we must eliminate and simplify this intricate, outgrown system to insure adequate traffic control over all aircraft whether operating *on* a civil airway or *off* a civil airway. Before outlining this new method of air traffic control let us look first at the present system now used to safeguard air traffic over the civil airways.

A civil airway today is an air space 10 miles in width, extending from one radio-range station to another. These are the highways flown by airliners flying along the radio beam without the necessity of seeing the ground. The CAA operates more than 300 radio-range stations and over 35,000 miles of civil airways across the length and breadth of the nation. Radio beams indicate to the pilot only that he is following a certain desired course or aerial highway. Therefore, the system of radio ranges is supplemented by approximately 500 radio position markers, in order that the pilot may know his exact position on the aerial highway.

The civil airways today connect the main cities of the United States. Some serve as flight paths for most of the airline traffic, while others are used for only one or two scheduled round trips per day. The total cost of establishing and operating an airway, including the installation of radio ranges, radio fixtures, maintenance and traffic control is very high. Transcontinental and other heavily traveled airways have proved to be a worthwhile investment but an airway set up for one scheduled flight daily obviously is neither economically nor aeronautically profitable.

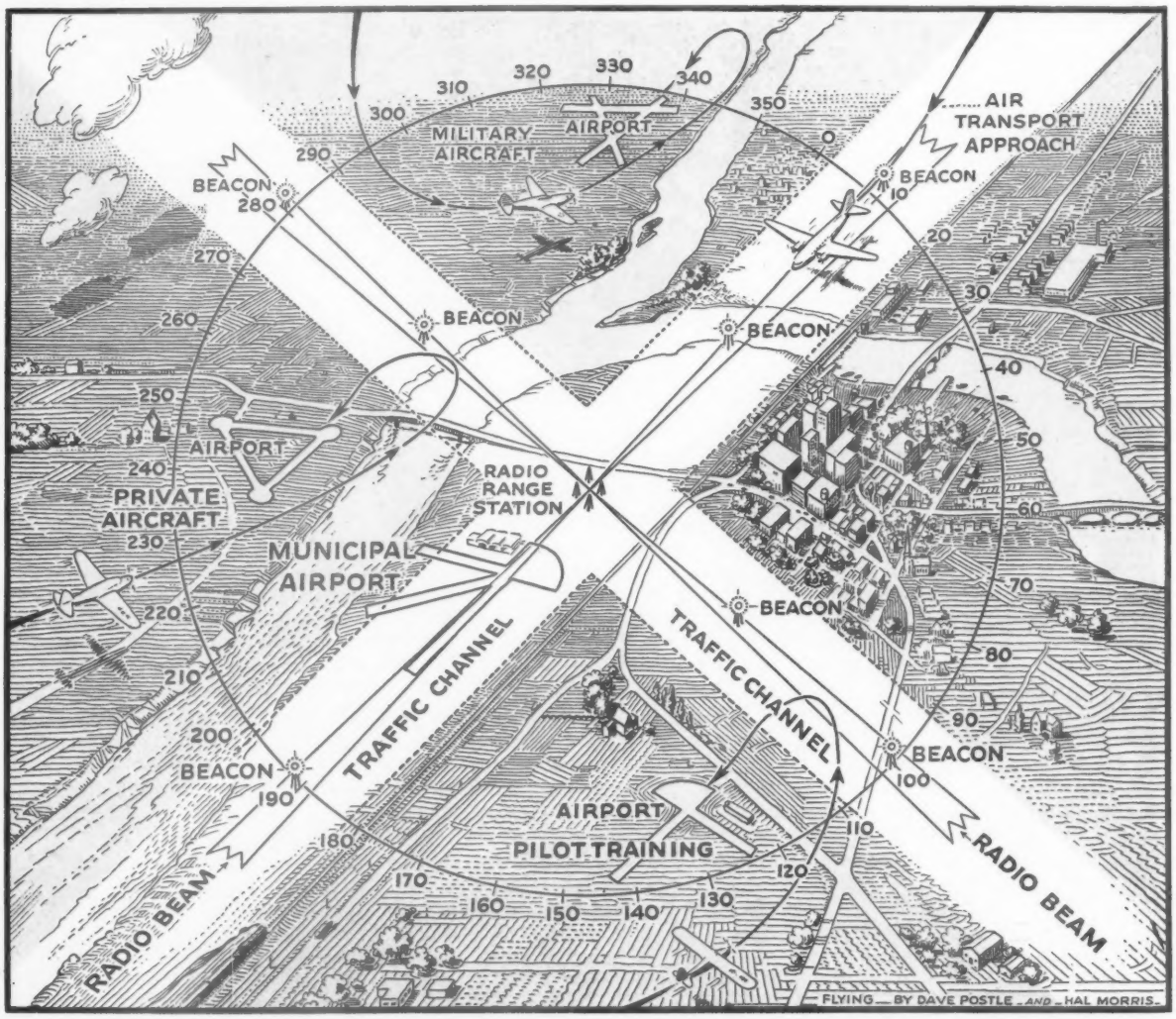
In Washington the Civil Aeronautics Board now has on file some 300 applications from companies desirous of operating domestic feeder and cargo airlines to more than 4,000 cities. Additional applications are arriving daily and indications are that most cities will demand some form of air service in the near future. Our present civil airways cannot be adjusted to link all these cities without hopelessly overlapping and intersecting in a labyrinth of confusion.

CAA engineers realize this better than anyone else and have already perfected plans for straightening out transcontinental and other main highways of flight to eliminate the present zigzag courses. In the beginning our airways linked major cities together for the economic reasons of trade and travel, rather than achieving the shortest distance between two points. In the straightening-out plan some of the air highways will by-pass large cities and partly alleviate the problem of cross-continent traffic. "Stub" airways will connect cities with "boulevard" airways. Plans further provide for a system of dual airways completely segregating flights traveling in opposite directions. These airways will be equipped with a new type of high-frequency "line-of-sight" radio range almost entirely free of static interference. However, it will cost millions of dollars to effect this modernization.

You can't see, feel or smell an airway. A pilot cannot determine that he is flying on an airway unless he has a radio receiver or a good aeronautical chart because airways are reservations bounded by imaginary lines measured from a radio signal. Flights outside these reservations, called "off-airway" flights, are continually infringing upon the airway space reservation. If we expand our present airway system, a tremendous increase in this conflict is bound to develop. Obviously, this will mean that additional restrictions will have to be placed on flights of private airplanes, which now and in the future will far outnumber commercial airline transports, if we are to properly safeguard the comparatively few flights *within* the airways.

Post-war air transports will fly nonstop from San Francisco to New York, Los Angeles to Chicago and between other large cities. The shortest air routes for these flights is a great circle course which does not coincide with our present or probable future airways. It would be uneconomical and absurd to require these long-distance, nonstop flights to follow our present civil airways.

This type of air transport operation will have to adopt a procedure similar to that used in transoceanic flights wherein the



How the type of control zone suggested by the author could be applied to a community, showing segregation of flight activities.

course of each flight is plotted prior to take-off in order to avoid storm centers and take advantage of prevailing winds. In pre-war flights between San Francisco and Honolulu, Pan American planes seldom followed identical courses. Establishment of airways for long-distance flights is highly impractical.

The fact that airliners are required to follow the comparatively narrow civil airways of our domestic routes has, in certain instances, projected flights through hazardous storm centers. If a pilot desires to deviate more than 25 miles from the center of an airway, he may now do so, but must later file a report to the CAA Administrator stating the reason. The psychological effect of such a regulation is that it might influence a pilot to plow through bad weather, rather than change his course in the interest of safety, go through the process of filling out a report and run the chance that some official might not approve of his judgment.

Instrument flight made in or above the clouds without seeing the ground is controlled within our airways in order that planes may be safely separated by altitude and time. Air traffic control of such flights is based on the filing of flight plans before take-off, stating departure time, route to be flown, estimated time of arrival at destination, and on radio position reports while enroute. Specially trained air traffic control experts constantly guide these instrument flights, and when planes become too closely grouped within any area, radio instructions keep them separated.

Each instrument flight within the airways is plotted on manually-operated flight progress boards. Each aircraft movement, such as a landing, take-off, or arrival at a radio fix, is recorded. Monthly reports of aircraft movements from each control center indicate traffic volume at any point in the traffic control system.

Radio direction finder dial. With this equipment a pilot can follow a course toward or away from a radio station and find position through triangulation from cross bearings.

However, when you read about the million-odd aircraft movements in the United States for a certain month, don't try to picture that many separate flights. A plane engaged in landing practice is credited with 10 "movements" for five landings. An airliner, flying nonstop from Washington to Boston, takes off, flies

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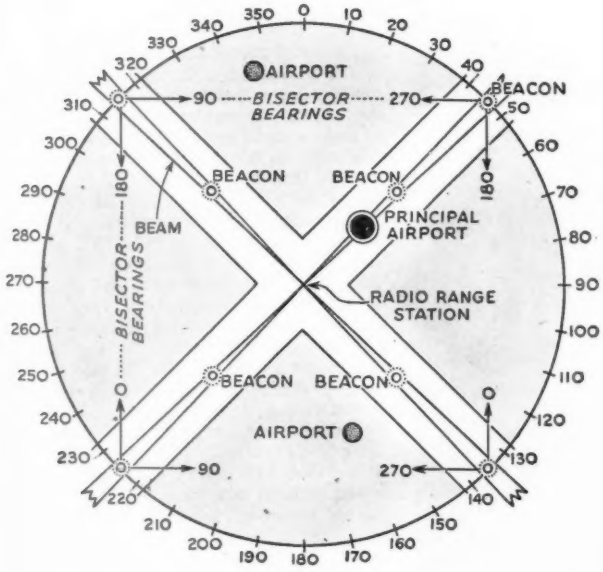
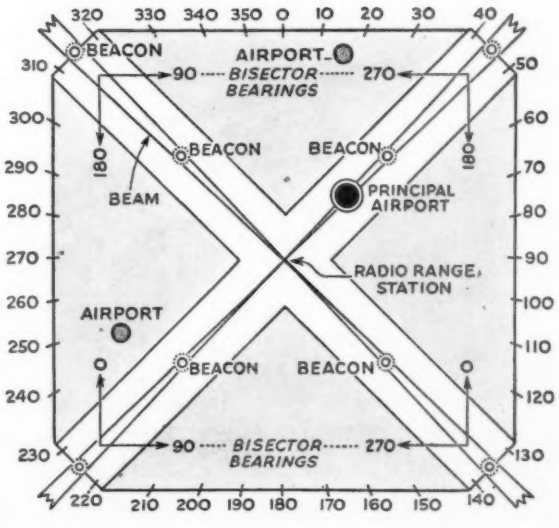


Suggested control zones, either round or square, would have two-mile wide approach channels for airline traffic.



Size of zones would vary with traffic. The four quadrants segregate specific types of flight from satellite airports.

Limitations of the HELICOPTER

By GROVER LOENING

Chairman, Helicopter Committee, National Advisory Committee for Aeronautics

Difficult to fly now, helicopters won't have controls simplified for general use for five to 10 years, author believes.

Crowds watch Sikorsky helicopter. Flying it requires co-ordination of five controls.

THE Buck Rogers type of predictions on helicopters must be discouraged. There isn't anything in the cards to indicate that grandma will be doing her neighborhood shopping in her latest helicopter or that the tired business man will be flying in his own little model to his chosen suburban community.

Advertising artists have gone overboard on the future of the helicopter. Picture magazines have simply let their imaginations run riot on the subject. We must call a halt to this sort of thing or Americans will have to face a period of disillusionment at the very time when faith in the future of the helicopter is needed to the greatest degree.

The true picture today, faced honestly, is that the helicopter will be limited to usage by professional pilots and professional aviation companies for the next few years. It is not at all a vehicle to be placed in the hands of the public. The way things stand today, the helicopter is even more of a professional apparatus than is the airplane.

Igor Sikorsky's eminently successful pioneering has given us our real start in this field. Developments are going on apace. There are some 70 or 80 different designs being worked on, out of which 10 or 12 will be successful. Three or four of these designs now are flying well. Some of the successful designs include those of Piasecki, LePage and Young.

The War Production Board now is granting materials and designating laboratories to several young pioneering engineers who have good new ideas in this line. The Army, Navy and Coast Guard are placing strictly military orders and developing strictly military uses for the helicopter. These cannot be disclosed except in a general way. The National Advisory Committee for Aeronautics is proceeding with an ambitious research program to make sure that no stone is left unturned in the interests of safety for the helicopter pilot and in the success of the technical development of this field in the United States.

The net result of a long, intensive study of the helicopter is that—for the present and for many years to come—it will be hard to fly. It requires the co-ordination of five controls, and for that reason is far less suitable for the use of the ordinary layman than is the airplane.

Any notion that everyone is going to fly helicopters as soon as the war is over is nonsense. The amount of skill necessary to fly these machines correctly and with safety is greater than that required to fly an airplane and is very much greater than that needed to drive a car.

This serious limitation is not insurmountable by any means. In due course of time the three airplane controls used for balancing can be placed on an automatic pilot mechanism. Engineers and designers eventually will develop a governor that will assure the proper rotor speed without any manual action on the part of the pilot. In somewhere between five and 10 years, in the author's estimation, the control of the helicopters will finally become sufficiently simplified to make these craft available for more general public use.

Another serious limitation on their use in the near future is the fact that helicopters are fundamentally limited in the speed they can attain as at present designed. The advancing blade, since its speed is always the sum of its speed of rotation, plus the speed of the whole machine advancing through the air, more quickly reaches the limiting airflow breakdown speed of sound than would an airplane. This speed of sound is around 1,100 feet a second and trouble in shockwaves has been run into by airplanes at around 800 feet a second. Since in large sizes it is impractical to develop the rotors to give the necessary lift without having a top speed of hovering rotation alone of much under 400 feet a second, this leaves a forward velocity of about 400 feet a second which would be equivalent to about 270 m.p.h. This is definitely in the high bracket and it is not likely for many years that helicopters will be developed which will fly much over 200 miles an hour. By that time there will be many airplanes flying around 400 miles an hour.

light disc loading required to meet autorotation requirements.

We have been taking a rather dark view of the whole situation, however. Because these limitations exist, it does not mean that helicopter development has too restricted a future. On the contrary, when handled by professionals, its professional future immediately after the war will be wide and extensive.

This means that helicopters will be flown by airline companies and commercial pilots. Mining companies and oil companies will hire pilots and purchase helicopters for exploration work and to carry personnel and goods to inaccessible places.

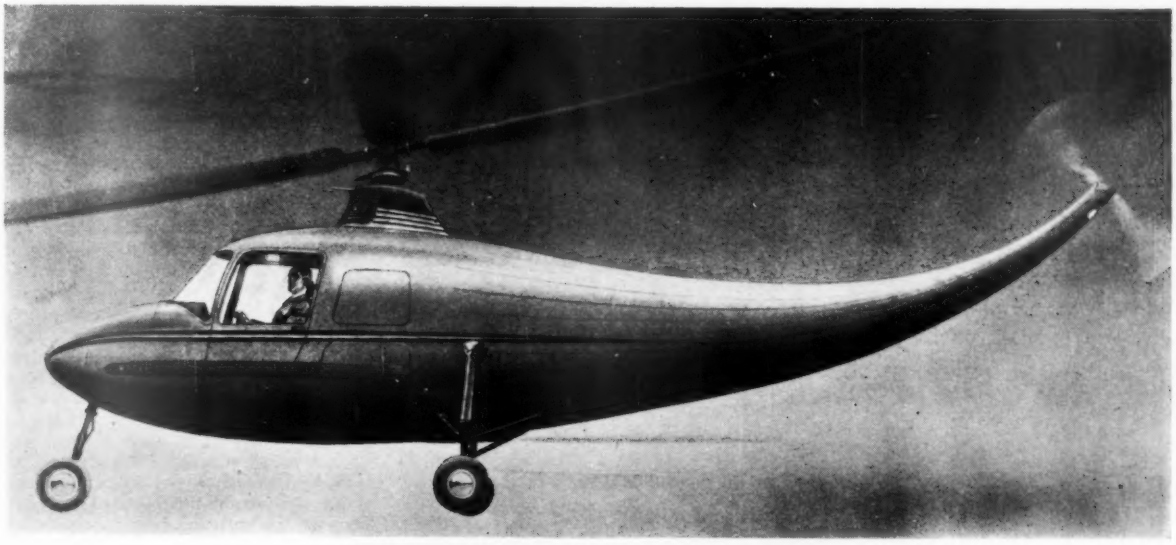
The U. S. Coast Guard is almost certain to end up by having over 90 per cent of its air fleet in the form of helicopters for lifesaving, ice patrol, law enforcement and coastwise work. At the crowded beaches of summer resorts the catamaran that has to be launched through the surf to go out to rescue a drowning person will be replaced by a lifesaving helicopter that rises off the beach and lands in

worrisome at the moment, but developments are under way which will greatly reduce this limitation to helicopter usage.

Reconnaisance, command movements by officers and liaison work can be done with extraordinary facility in helicopters in use today. But one must bear in mind that the helicopter's ability to land and operate from inaccessible places is always subject to its being in the hands of an expert pilot—a pilot who can co-ordinate those five controls.

On an airplane, the forward and backward movement of the elevator stick at once accomplishes two functions. It balances momentarily the fore and aft maneuvering, and, by changing the position of the plane, causes it to go up or down. On an airplane the three controls, elevator, aileron and rudder, are all that are needed for ordinary flying at a set cruising speed, and the pilot need co-ordinate only these three.

In the case of the helicopter, however, this is not the case. The fore and aft movement of what corresponds to the airplane's elevator stick does not cause the



Artist's drawing of helicopter designed for Higgins Industries.
More than 70 different helicopter designs are being worked on.

A third limitation of the helicopter is a definitely poor performance at increasingly high altitudes. As the helicopter is envisioned at present, if it is efficient at sea level, it is not an efficient machine in rarefied air.

There also are quite serious limitations on size but this might be met by the development of multi-rotor machines.

Many of these limitations are due to preserving the requirement that a helicopter must at any time with engine dead be able to become an autogiro and autorotate to a safe landing. Present helicopters can do this. However, as the art develops, we may find that this requirement is a deterrent to development that is not warranted. Possibly the development of twin-engined power plants or of parachutes or some other emergency device might allow a heavier disc loading that would be far more efficient than the

the roughest kind of water right at the spot where the drowning person may be picked up.

Of course, in war usage, one of the most outstanding features in which the helicopter could be used at once is in ambulance work, to fly out casualties from inaccessible places.

In addition, a war use that has been much talked about would have been the use of helicopters from the decks of vessels against submarines. There is little doubt that, had the submarine menace continued as seriously as it looked a year or two ago, this development would have assumed great importance.

There are countless other military uses for the helicopter, particularly due to its ability to operate in the thickest, roughest weather. Fog is not a detriment because in the helicopter you merely slow up when you are near obstacles. Ice is

helicopter to go up or down. What it actually does when held for a prolonged time is to cause the helicopter to go forward or backward at various speeds. In order to go up or down an additional lever has to be used, called the pitch and control. To further complicate matters, the movement of this pitch control lever must be carefully co-ordinated with the throttle of the engine because the application of too much pitch angle might slow the blades down dangerously and spoil the balance of the centrifugal force holding the blades out against the lifting force. The helicopter pilot, after using his three airplane controls with which to do ordinary balancing, has to co-ordinate the pitch control with the throttle.

What the future types of helicopters are likely to be is still not clear. Much technical development is still to be done.

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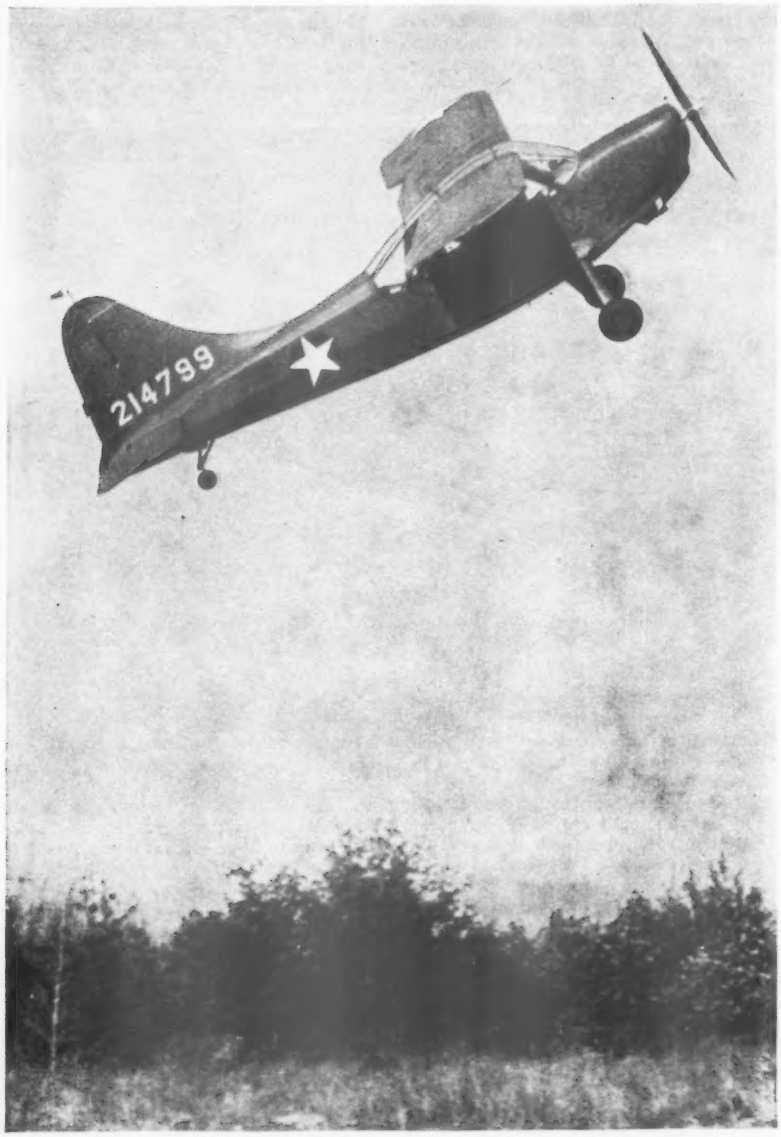
LIGHTPLANES FOR WAR

by CLARENCE CURTIS

The Russians have employed lightplanes successfully, and now a U. S. infantry officer, Lieut. Col. John C. L. Adams, outlines a detailed plan for their use.



Used by the Army Air Forces, the Stinson Sentinel is small, rugged, can operate from highways or improvised landing fields. Directing artillery fire, it hovers at 45 m.p.h.

LIGHTPLANES played a major role in last autumn's successful Soviet offensive which drove the Germans out of the Southern Ukraine. In a single action they strung parachute flares in the sky to guide tanks to previously-reconnoitered weak spots in the German lines. Then, gliding with engines cut, they bombed the German gun positions.

Later that night new flares continued the tanks on their way to a decisive break-through of the German lines. The little puttering planes that the Germans call "Whispering Death" bombed and strafed the enemy defending the weakened line and held off the German infantry until it had consolidated the tank break-through. Later still, the slow-flying little aircraft successfully bombed the counter-attacking German infantry and mechanized forces.

This amazing demonstration of air-ground co-operation was not achieved with high-speed fighter bombers, nor even with the heavily-armored Stormoviks, but with the little U-2 biplanes powered by 110-h.p. engines which give them a maximum sea level speed of 93 m.p.h. Designed by N. N. Polokarpov, the U-2 weighs 1,331 pounds empty and 1,892 pounds loaded. It has a crew of two and is variously used as a primary trainer, an ambulance plane and a light bomber.

The Red Army's use of lightplanes in war represents a revolutionary concept in ground-air co-operation. It was superbly demonstrated in last autumn's offensive in the Ukraine, which drove the Germans across the southern Dneiper River and cut off those troops still left on the Crimean Peninsula.

A description of this offensive by Lieut. Col. Y. Aksenov, Soviet military commentator, stresses the flexibility of lightplanes in war. In assisting tank movements at night, the lightplanes guided them to their objectives over devious routes which they had previously scouted by daylight. Their string of flares was hung up in the sky in a pre-arranged pattern, usually about two miles ahead of the advancing tanks.

Simultaneously, a number of Soviet aircraft attacked enemy artillery positions and troops lying in the path of the mechanized forces and when the tanks had entered the gap blasted by the planes the aircraft secured their flanks by protecting the most vulnerable points.

When the mechanized forces broke through in the direction of Meshkovo, a strong force of enemy tanks attempted to cut off the Soviet storm troops on their flanks. Then the light night bombers centered their attacks on the German mechanized columns and beat back the enemy.

In another instance, when Soviet tank units broke through to the regional center of Veseli, a threat was created to their right flank during the night. Light bombers on assignment from the tank unit continually bombed the counter-attacking

One of the "eyes of the artillery," a Piper Grasshopper observation plane lands on road during maneuvers at Fort Bragg, N. C.

German infantry and mechanized forces and eliminated the threat. Such operations invariably brought success during the fighting in the southern Ukraine.

On a number of nights when stubborn battles were being fought for the populated localities of Kolpakovka and Nadezhni, Soviet light bombers not only illuminated a route for the tanks but launched heavy raids against the enemy defenses. Their work materially aided the Soviet troops to capture these points.

To prevent colliding in the air, the Soviet pilots had to take off at a carefully specified time, fly at specified heights for their bombing. To facilitate their work of leading tank units, the tanks signalled their bearings by rockets.

Another form of joint action between the light bombers and ground forces at night was a simultaneous mass assault by aircraft and artillery. As soon as dusk set in, U-2's singly and in pairs raided the enemy gun and mortar emplacements.

There was no respite at daybreak. Shortly after dawn, 39 U-2's suddenly appeared over the enemy defenses and, as soon as the first bombs were released, the artillery opened up according to plan. After a combined artillery and aerial barrage of 20 to 25 minutes, tanks and infantry attacked and pierced the enemy lines to a depth of five or six miles.

Planes participating in this operation used three flying fields. Organization for the combined operations entailed the closest co-operation with ground troops.

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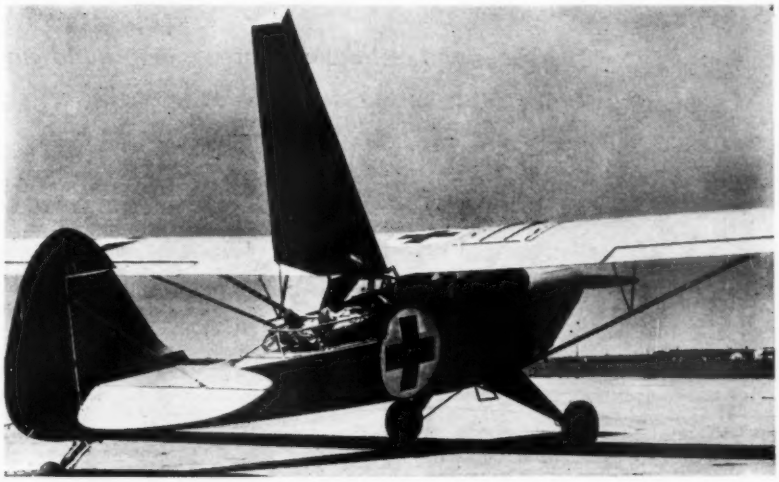
Two Fifth Army reconnaissance pilots dig foxholes after landing under fire in Italy.



Another example of lightplane utility in war—trapdoor lifts to admit wounded man.

SEABEES AT WORK

By JOSEPH A. BORS
Washington War News Editor, International News Service

Seabee-manned crawler tractors haul earth-moving machinery in construction on Adak, Aleutian Island air base.

Seabees land with the fighting men, build under fire if necessary. They construct air fields, roads, docks, defenses, miniature cities.

ONE of the most thrilling American victories in the Pacific is being won by the famed Seabees, the Navy's fighting construction battalions.

The Seabees have built the airfields for our land-based planes. They have cleared the trees, drained the swamps, levelled the hills, laid the steel mats, crushed the gravel, mixed the concrete for those airstrips which have grown like magic from the jungles of the South Pacific Islands to the barren wastes of the Aleutians.

They have built the barracks in which our airmen are housed, laid down the roads to supply them, unloaded the ships and moved the supplies off the vulnerable beaches. Without the Seabees, our land-based air operations against the Japs would have been impossible.

Beginning with an experimental group of 99 men in October, 1941, the Seabees had expanded to 262,000 a few months ago. More than 100,000 are already overseas—mostly in the Pacific. They are writing their chapter of the war with bulldozers, power shovels, carryalls, sheepsfoot rollers, tractors, trucks and other heavy construction equipment.

High-ranking Army and Navy officers, including the boss of the Seabees, Vice Adm. Ben Moreell, chief of the Bureau of Yards and Docks, have been loud in their praise. Moreell himself attributes their success largely to the fact that construction men were recruited for the Seabees, and construction men were recruited to supervise them. They have carried over a high morale from civilian life into the service, he says. The result has been near-miraculous.

When American forces invade an island, Seabee construction battalions land behind the first waves of fighting men. Under fire, they go to work with bulldozers, steam shovels and other equipment on roads, air strips and construction projects.

Typical was the airfield carved out of dense New Guinea jungle under torrential rains in only 13 days by a construction battalion under Comdr. J. C. Tate of Jefferson City, Mo. It provided a much-needed facility for planes to back up the offensive that swept the Japs off northeastern New Guinea.

The Seabees landed on the morning of July 2, 1943. By 7 a.m. work was underway. First ashore were the bulldozers which plow through underbrush like a bull elephant on a rampage. Meanwhile other workers were busy dynamiting the larger trees, which tractors snaked away.

During the first 11 days more than 16 inches of rain fell, yet work continued 24 hours per day. Even bombing attacks by the Japanese interrupted activities for only brief periods.

Once the jungle had been pushed back, the bulldozers leveled off the flight strip. A runway 3,000 feet long and 150 feet wide was staked out. The entire strip was surfaced with 18 inches of crushed coral rock, packed to concrete hardness by rollers.

By July 14 the first 3,000-foot strip was ready. Five days later it was extended another 1,500 feet. It has since been lengthened to 5,900 feet.

Seabees consider bulldozers their most valuable "weapons" in the war against the jungle. They also help pull trucks out of mud and make rough jungle trails for other vehicles to follow.

On New Georgia Island a bulldozer wiped out a nest of Japs. A Seabee aboard his bulldozer was moving into the work area when a hidden Jap machine gun nest opened up. The operator raised the blade of his machine as a shield against bullets and roared down on the Jap position. When he got within striking distance, he lowered the blade and buried the Japs alive.

Before a base is built, the Seabees help to get the supplies ashore. This involves not only unloading the ships but fitting the lighters together and constructing temporary or permanent wharves and other landing facilities.

After the supplies are ashore, Seabees must rush them off the vulnerable beach. This requires construction of storage facilities and bivouac areas. One of the first jobs of Seabees is to aid in setting up defenses, which they help man, if necessary. Another is the construction of roads over which supplies move to the front.

Once established on the ground, the Seabees construct the advanced base. This includes landing strips, barracks, hangars, machine shops and storage facilities for fuel and supplies, including powder magazines and underground storage tanks for aviation gasoline and fuel oil.

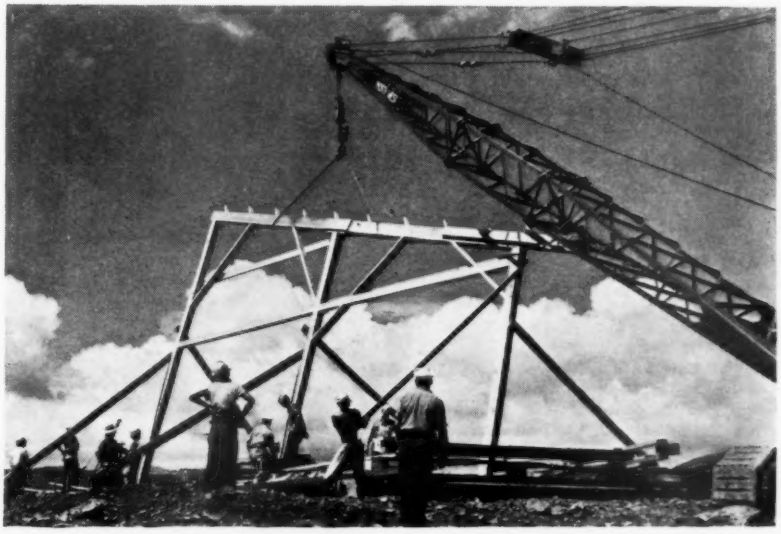
A base also must have utilities. Seabees dam mountain streams and pipe fresh water to the camp, or set up water purification systems. They install telephone and electric systems, including loud speaker air raid warning networks.

They usually set up refrigeration plants, malaria control works, cantonments and hospitals, and repair facilities to service everything from damaged warships to broken machine guns.

Whenever possible Seabees use captured enemy equipment and material. Portable sawmills enable them to use local lumber.

When Seabees followed the Marines in the original landing on Guadalcanal, much Japanese equipment was left intact.

Protected against malaria-bearing mosquitoes by netting, Seabees build a road at a South Pacific base. They know road building, practiced it as civilians.



Building a warehouse at a South Pacific base. Seabees are charged with unloading ships, constructing wharves, getting supplies off the beaches and storing them.

Seabees build emplacement for 40-mm. guns on Attu. Besides having to know how to use tools, Seabees are trained to handle guns in case they should have to fight.

Seabee-operated shovels and trucks build embankments to protect Aeronca Grasshopper observation planes from Los Negros Airfield, Admiralty Islands.

Among captured materials were steam rollers, trucks and even a refrigeration plant. When the Seabees landed on Tarawa, Jap steamrollers were put to use on the damaged airfield while fighting still was in progress.

When the Japs dropped their bombs on Guam, Wake and in the Philippines, the necessity to protect such bases with men who could set them up, keep them operating and fight, if necessary, became apparent. Thus Seabees now handle guns or tools with equal facility.

A Seabee is trained to be an efficient man at the end of a rifle, a fellow who can throw grenades with the best of them, or who can aim a deadly stream of tracers at attacking planes.

Members of this select group are proud of their emblem—a flying bee with a seagoing sailor hat perched atop its head. In its forelegs it clutches a spitting tommy gun In the others a wrench and carpenter's hammer. On the three legs showing on one side are the rating badges of gunner's mate, machinist's mate and carpenter's mate.

A list of principal trades represented in the construction battalions includes:

Blacksmith, bulldozer operator, carpenter, concrete worker, construction worker, dredge deckhand, quarry driller, electrician, engine operator, excavation foreman, dredge fireman, gasoline and Diesel engine repairman, labor foreman, launchman, dredge mate, mechanic, oiler, shovel operator, painter, piledriver foreman, pipefitter and plumber, pipelayer, powderman, rigger, road machine operator, sheet metal worker, coppersmith, steel worker, telephone man, truck driver, water tender, welder, wharfbuilder, boatswain, draftsman, etc.

Two Navy Seabee battalions created a small city for 6,000 men on an unidentified island in the South Pacific in the incredibly short time of 17 days.

Under Lieut. Comdr Frank B. Campbell, Nashville, Tenn., and Comdr. Walter A. Blue, Clayton, Mo., the battalions cleared and graded 30 acres of land. Then, within the allotted time they surfaced two miles of road, laid 8,350 feet of pipe, built 186 Quonset hut barracks and 22 Quonset latrine huts, erected three frame chief petty officers' quarters, two frame bachelor officers' quarters, and six frame enlisted men's barracks, dug dry wells with a 6,000-man capacity, put in power services, poles, line and transformers and made ready the mess halls and galleys so that the first soldiers to arrive could sit down to chow.

The Seabees waste virtually nothing, salvage much. On one remote island their ingenuity was rewarded with ice cream for dinner.

The Seabee stevedore and longshoreman battalion had just unloaded the last of a long line of transports and was in a mood to celebrate. The cook had the ingredients for ice cream but no freezer.

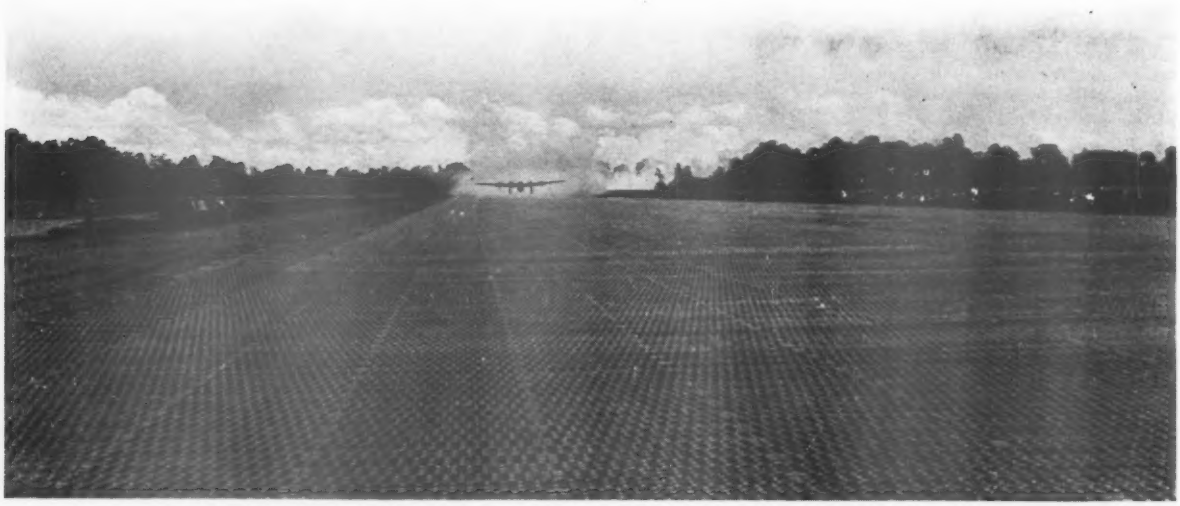
Several Seabees went hunting on the salvage pile. One man chiseled the head off a big oil drum. Another found a smaller drum and fitted it into the big one with just enough clearance for brine. Discarded brass tubing was wound around a palm stump to make a cooling coil. Fins for the agitator were cut from a big artillery shell.

With other assorted items, the collection was assembled, polished and tin-plated, then hooked up to a dough-mixing machine and refrigerator. In went 10 gallons of the cook's mix and out came ice cream.

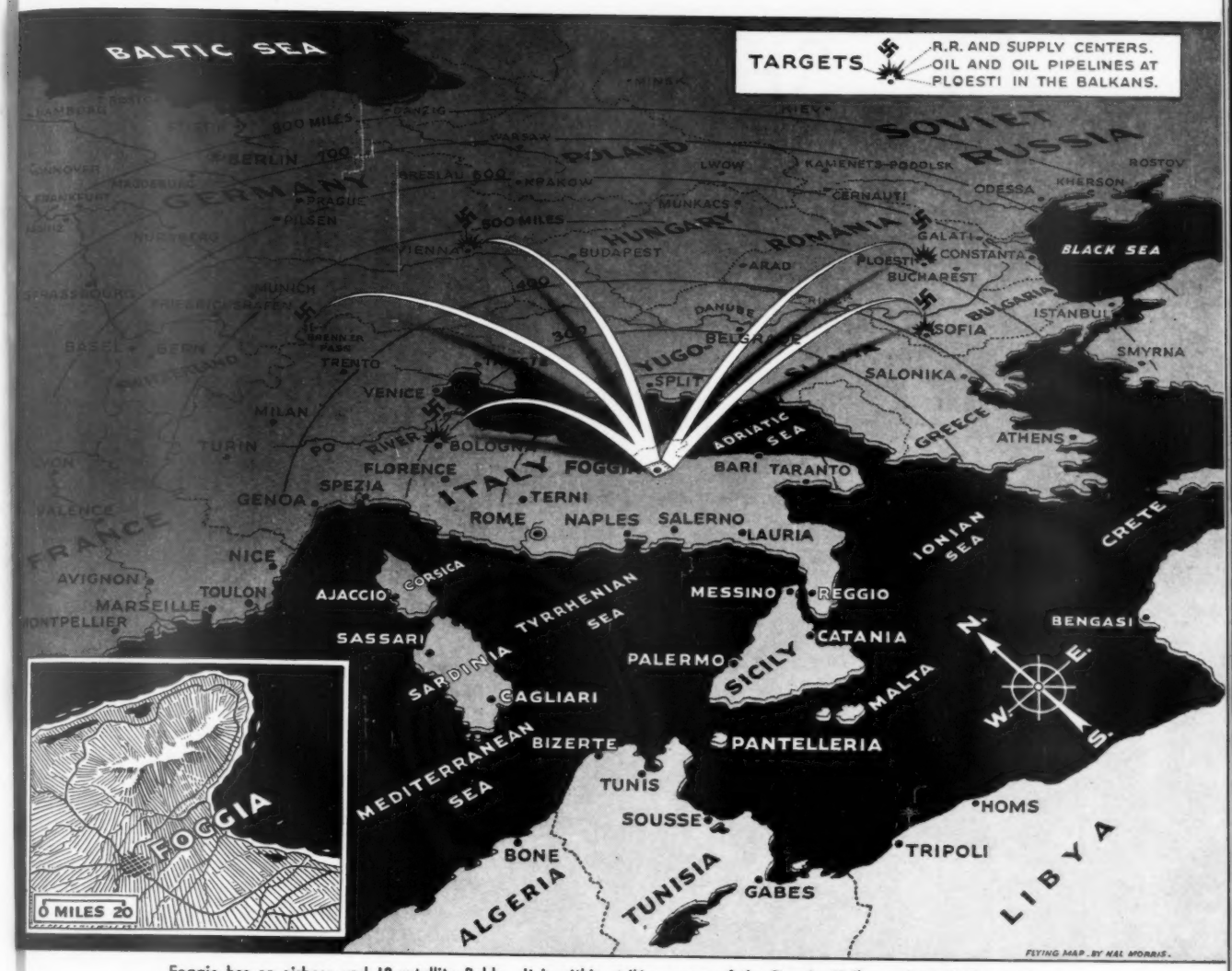
On another island many an item of equipment is labeled: "It's a Jaegler Product." The creator is Chief Shipfitter Anton J. Jaegler, Redding, Calif. Some of his creations include:

A 23-inch drill press made from an automobile transmission, eight-inch channel iron and two bomb-bay screws from a B-17.

(*Continued on page* 134)



Liberator takes off from steel runway mats laid on surface leveled by Seabees. Mats give firm support on soft ground



Foggia has an airbase and 12 satellite fields. It is within striking range of the Danube Valley and south Germany.

FOGGIA—Airpower Symbol

By CHARLES CORDDRY, Jr.

Carefully-timed waves of Allied planes neutralized the great Italian base from which our airpov er now covers southern Europe.

THE armchair student of *Festung Europa* might well skip both Dieppe and Pantelleria and examine the more instructive lessons in the preparation of Italy for invasion, particularly in the employment of air power to knock out Foggia prior to capture of that vital nest of air fields by the Eighth Army.

Dieppe was a reconnaissance in force; it mainly demonstrated to the world that Hitler had ringed his *Lebensraum* with high-caliber steel. Pantelleria, deviled by our air power and battered from the sea, was a pushover; we dominated the skies and the water, and there were only 32 square miles of resistance to overcome.

But Foggia was something else. It stands as a symbol of the way airpower opens doors to armies. It represents a pattern for precise strategy and activation of plans which made it an easy mark for Gen. Sir Bernard L. Montgomery's troops.

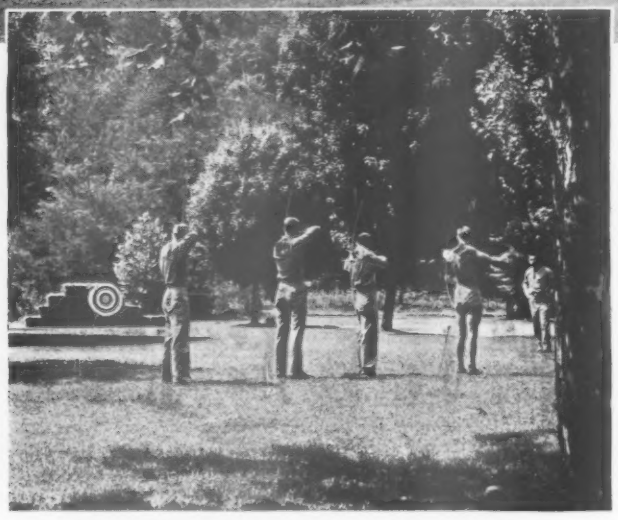
Something of the importance of Foggia may be gathered from its size. Far from being a cross-roads Italian village, it is a city of 85,000—about the size of Sioux City, Ia., and larger than Mobile, Ala., or Pasadena, Calif. From a military viewpoint, it was one of four communication points linking northeastern and southern Italy. It was an important Nazi administration center, rail junction for troops and supplies and concentration point for German air might. It consisted of the huge air base at Foggia proper plus a ring of 12 satellite airdromes.

President Roosevelt hinted at this during the southern Italy campaign when he said it was no secret that the German general staff had drawn circles around several strategic spots in Europe with Foggia as the center.

Imperative as it was to blot out the city as a Nazi bastion, Foggia was still more

(*Continued on page* 118)

AAF SHANGRI-LA



AAF enlisted men sojourning at Lake Lure are quartered in Rocky Bound Inn (above), officers in Lake Lure Inn.

Archery is one of many activities available at Lake Lure.

By
Sgt. J. J. LICHMAN

Establishment of rest camps such as this North Carolina haven is the G.I. method of overcoming flying fatigue.

LAKE LURE! The very name suggests a spot of alluring, intriguing beauty. And well it may, for the setting of this emerald-colored lake in the picturesque mountain region of North Carolina is as intriguing as its title.

Lake Lure has more than mere scenic beauty to commend it today. Here, since last July has been located what is probably the most unmilitary camp in the United States.

At this camp no bugler sounds reveille or retreat. There is no drilling. No tours of guard duty. No formations. No inspections. No curfew. Rather, the whole atmosphere is that of a resort. Juke boxes in the nearby post exchange and the rec room grind out the latest tunes from Tin Pan Alley. Soldiers stroll about dressed conspicuously at variance with Army Regulations. Some of the men are playing volley ball and tennis; others are leisurely reading, writing or playing cards.

Sounds incredible and soldiers invariably ask, "But is the camp *strictly* G. I.?" Yes, as G. I. as a jeep or a set of dog tags. Officially known as the Lake Lure Rest Center, the camp is a unit of the Army Air Forces. Air Forces personnel suffering from the effects of fatigue and overseas duty are sent to Lake Lure for rest and recuperation.

Underlying the establishment of the rest center at Lake Lure is the story of the Army's concern with fatigue. It has long been known that fatigue is an important factor in causing a decline in industrial efficiency. It is being recognized increasingly that fatigue is likewise a serious threat to combat efficiency—especially flying fatigue.

Unheeded or unchecked, flying fatigue may have disastrous results. In the air, what counts is not brawn so much as brain and muscle. Upon quick thinking, alertness, emotional stability, often hinge the success or failure of a mission. Anything like fatigue which tends to lessen mental activity must be counteracted without delay.

As aids in offsetting flying fatigue, aviation medicine places great stress upon proper diet, ample rest and sleep, daily exercise and pleasant living quarters. But experience has shown that these aids are, in many instances, insufficient. Often a complete change of environment and a rest from flying are necessary.

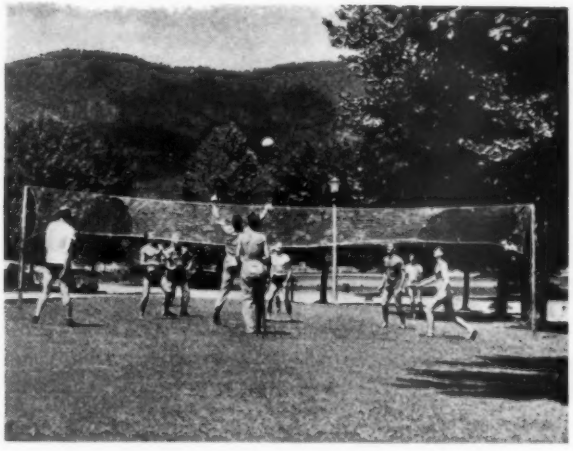
At the Army-sponsored rest center, under controlled conditions, fatigued AAF personnel are given big doses of the three R's—rest, relaxation and recreation. After 10 or 20 days, or as long as necessary, they are restored to active duty.

The rest center at Lake Lure, the first camp of its kind in the United States, was opened in July, 1943. It was sponsored by the Third Air Force, whose headquarters are in Tampa, Fla. The American Red Cross stepped forth to assume responsibility for the recreational and athletic facilities of the rest center.

Nerves frayed in aerial combat find sure rejuvenation here

Nearby towns provide girls as partners for weekend dances.

A nine-hole golf course is open to all Shangri-La guests.



Airmen choose their own sports, play when and if they please.

It is doubtful whether the Third Air Force could have located its "Shangri-La" in a more ideal spot. It is set high in the mountains amidst a wealth of gorgeous scenery. A short distance away is beautiful Lake Lure itself, with the Blue Ridge mountains forming a magnificent backdrop.

Like the original Shangri-La of James Hilton's imagination, this military edition, too, is secluded and sheltered, fairly remote from "civilization." A picturesque, Shangri-La-ish touch is the monastic-like structure embracing the administration offices of the rest center and Rocky Broad Inn.

Air Forces personnel are assigned to the rest center on a priority basis. First priority goes to Air Forces fighting men returning from overseas and suffering from fatigue. These men are sent directly to Lake Lure or to similar rest camps at Kerrville, Tex., and Castle Hot Springs,

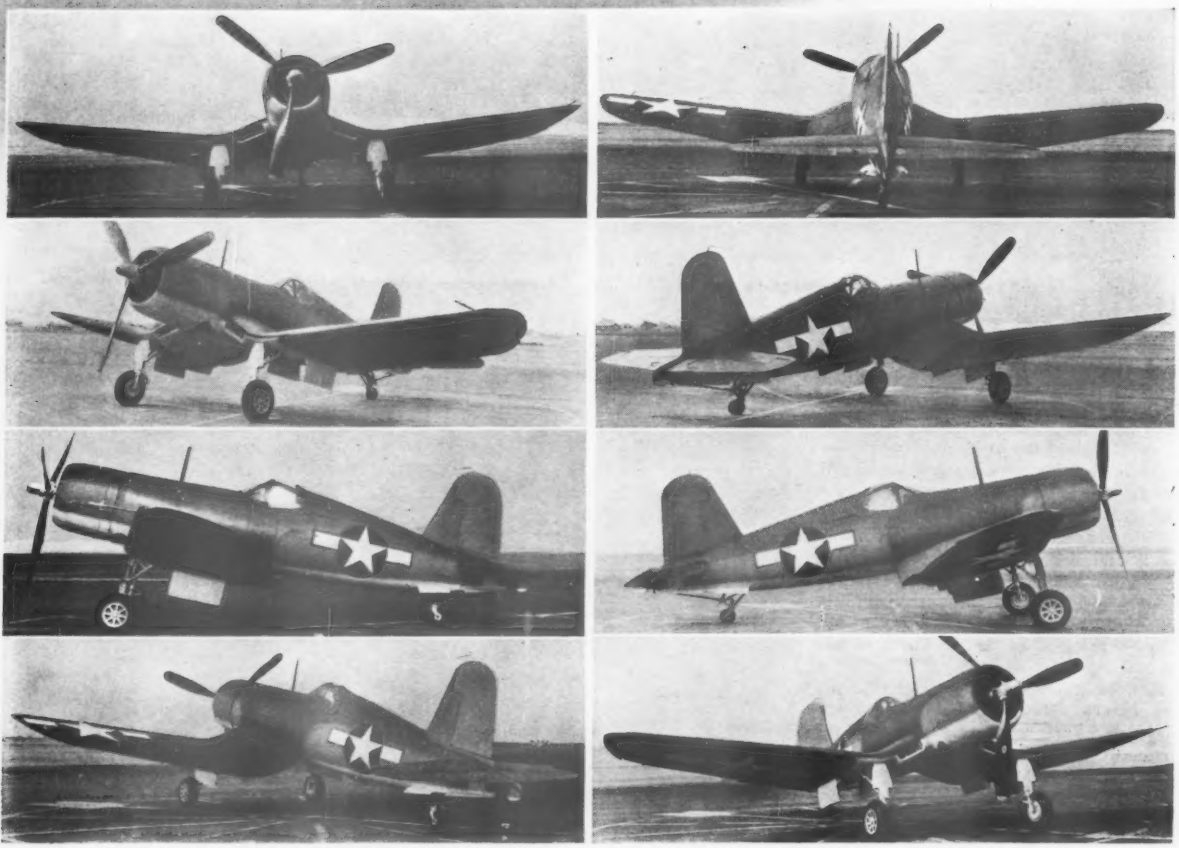
(*Continued on page* 126)

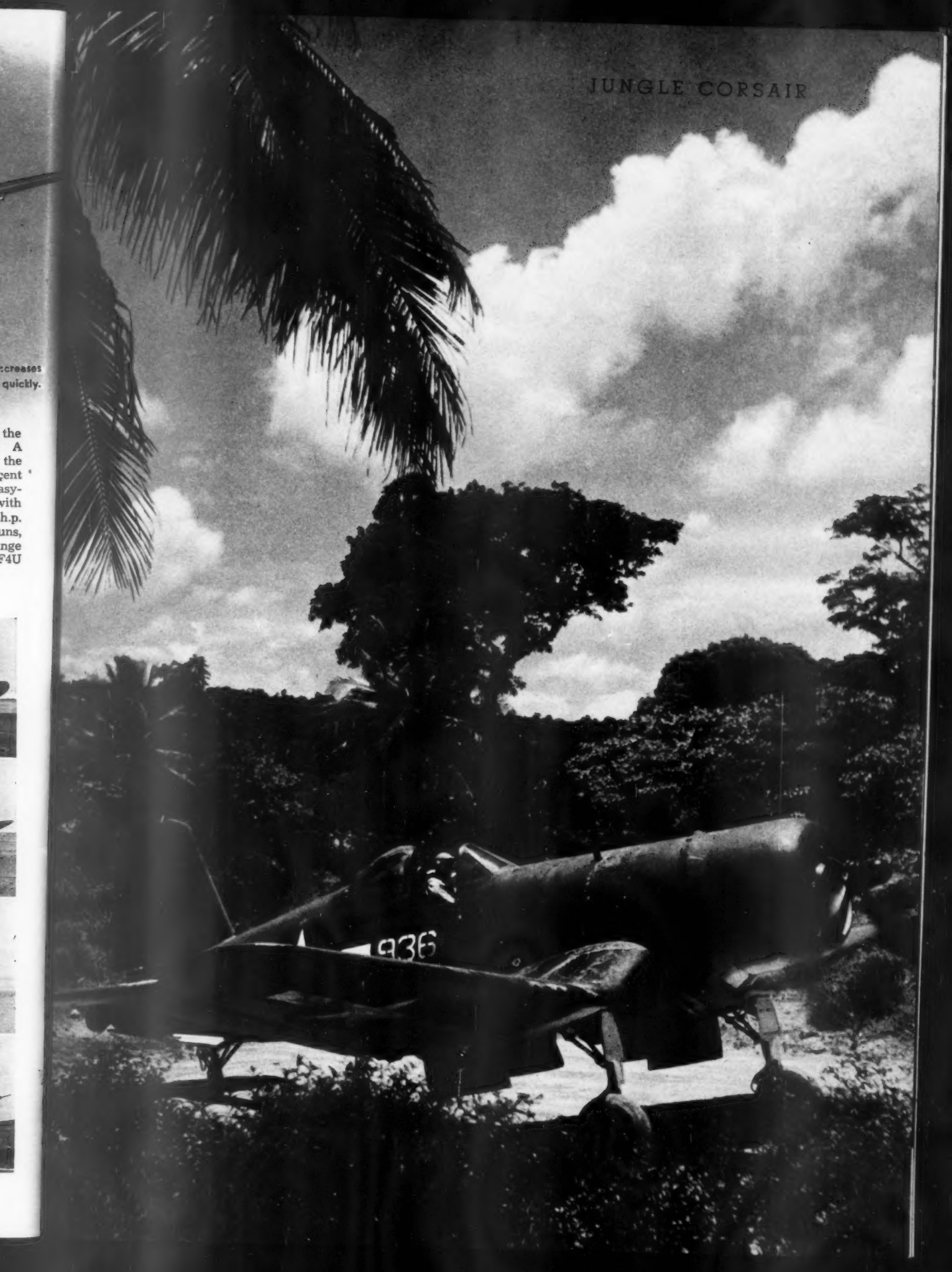
All is play and rest at Lake Lure, where only regulation is daily signing of register.

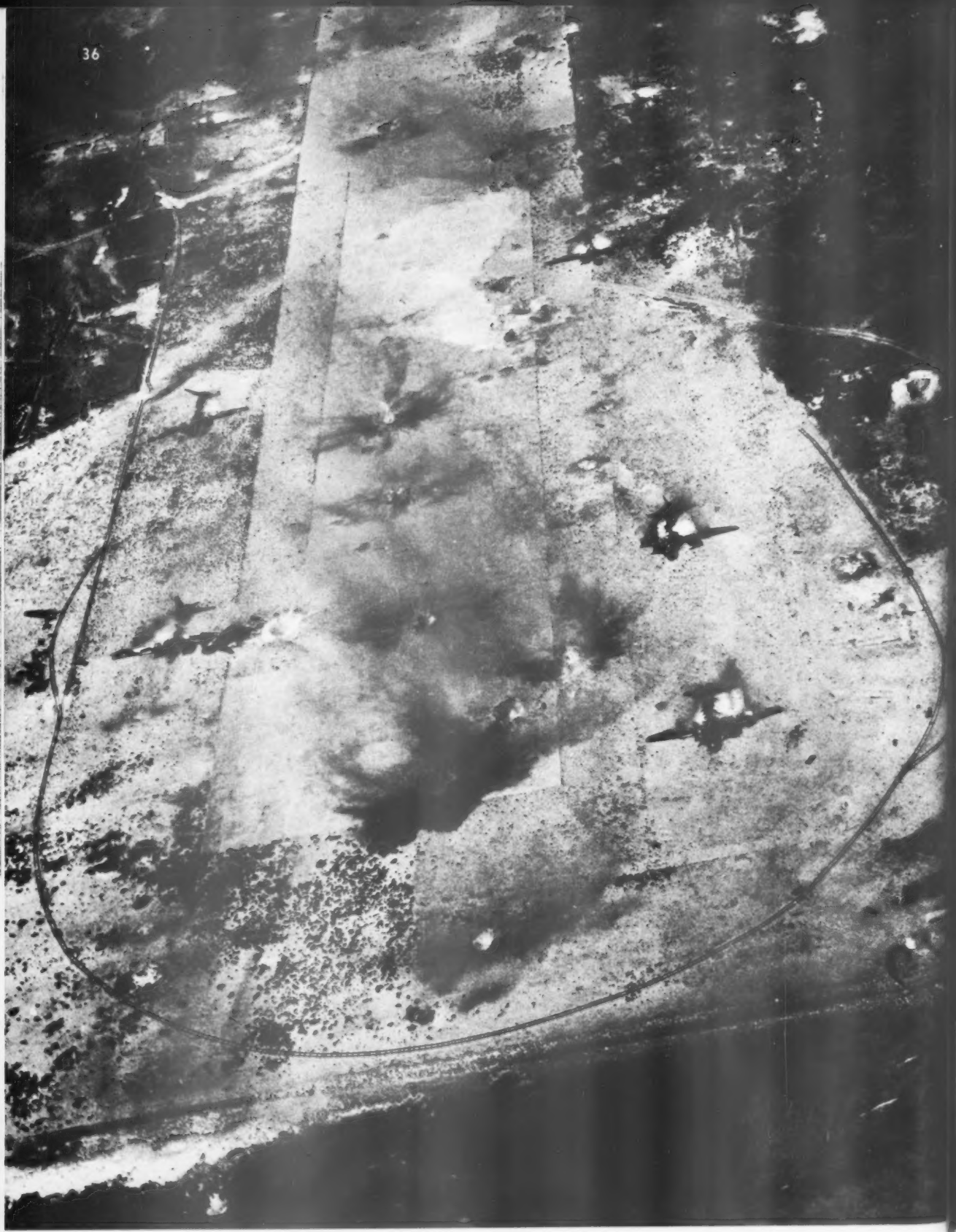
CORSAIR

New belly fuel tank greatly increases plane's range, can be dropped quickly.

THREE manufacturers are in large-scale production on the Vought *Corsair*: Brewster, Goodyear and Vought. A highly successful land-based fighter, the *Corsair* is the particular favorite of the Marine Corps. Most recent Marine aces made their marks with *Corsairs*. An easy-to-recognize airplane, it has a low, inverted-gull wing with a span of 41 feet. The engine is an air-cooled, 2,000-h.p. *Double Wasp;* armament is six .50-caliber machine guns, three in each wing panel. Top speed is "over 400", range 1,500 miles. Technical Navy designations are F4U (Vought), F3A (Brewster) and FG (Goodyear).




JUNGLE CORSAIR



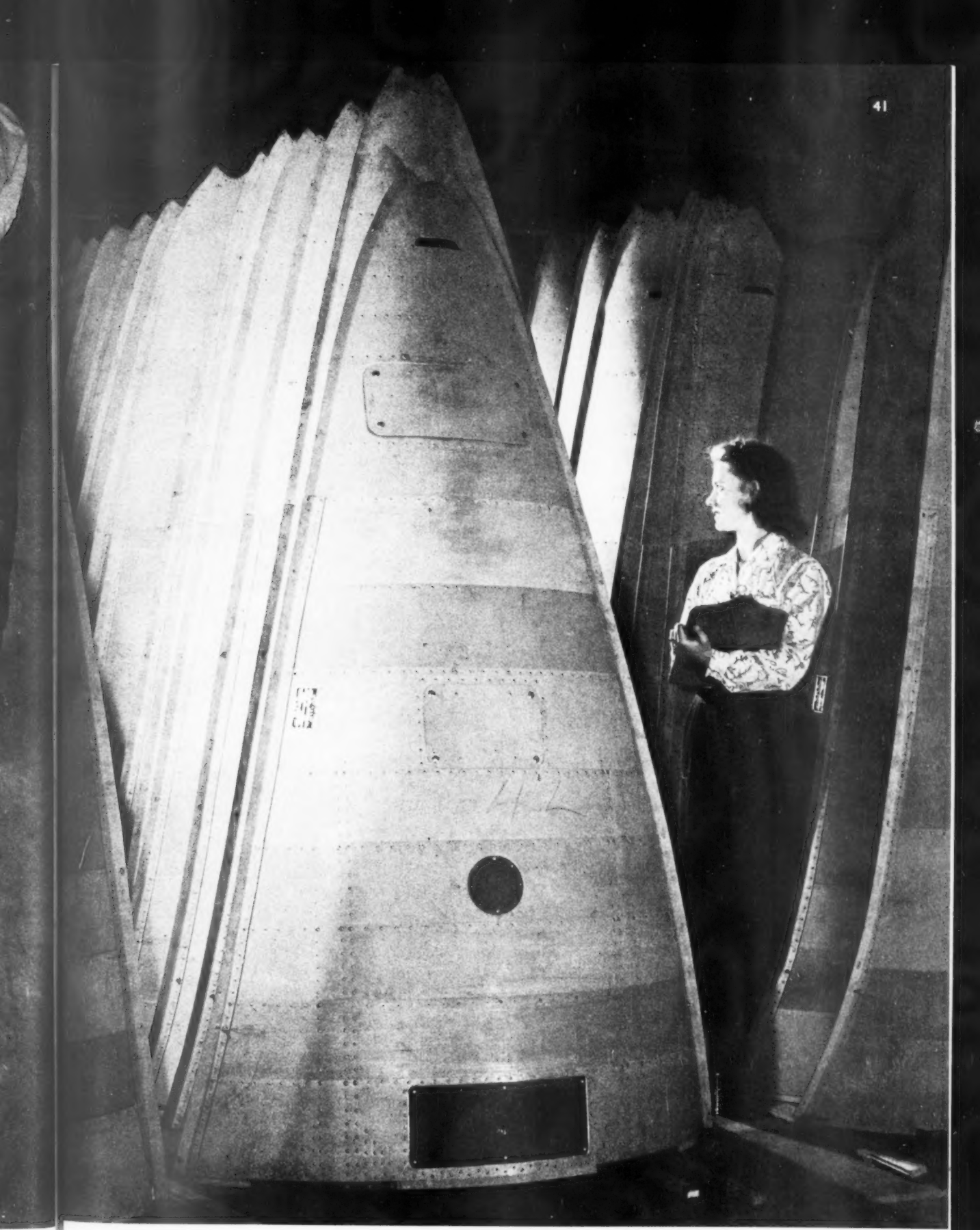
BLASTED BETTYS

ENIWETOK-BOUND

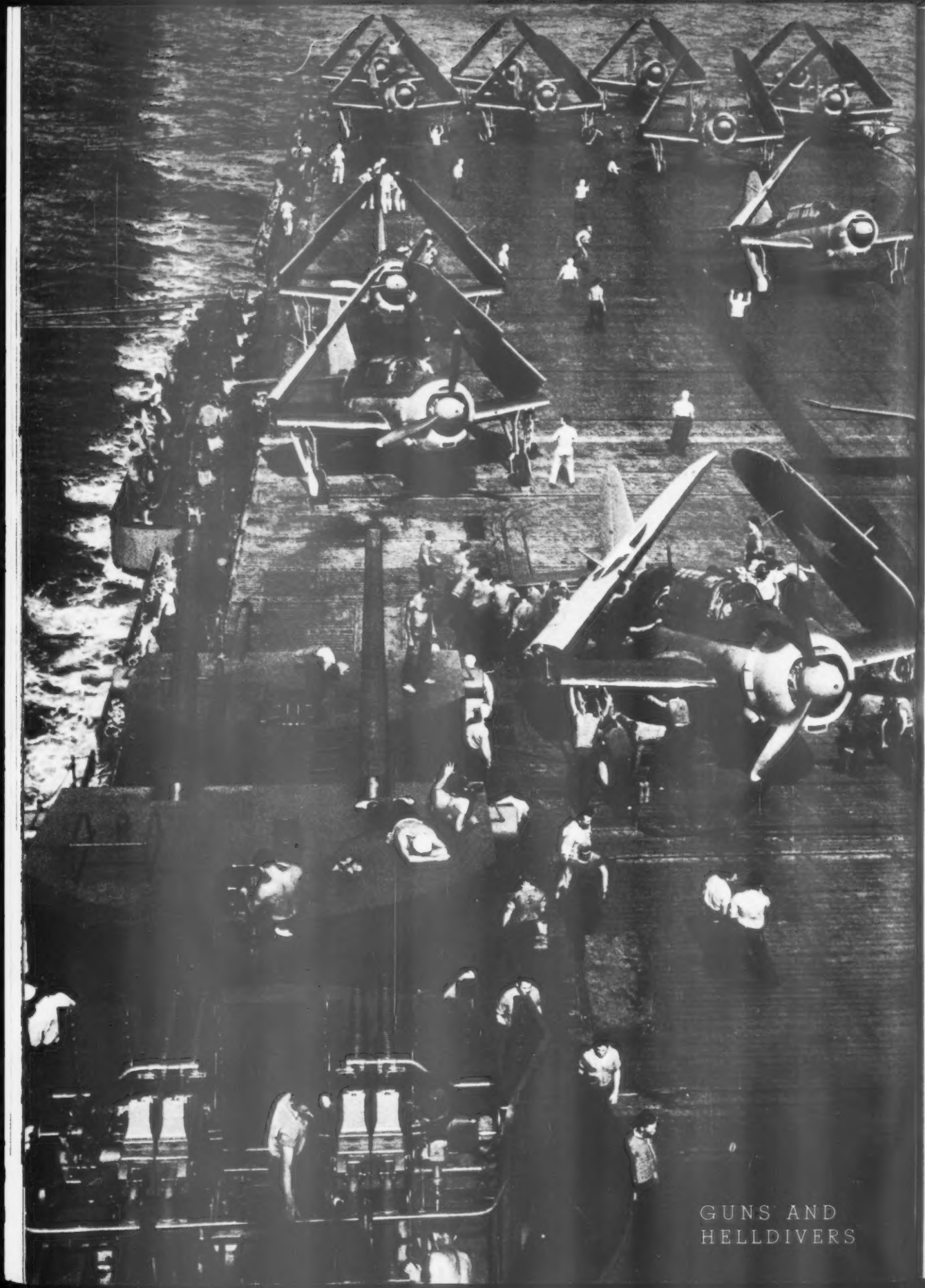
KINGFISHER
DES-17

U.S.COAST GUARD
V 190

BOMBER'S BUBBLE



FAIRING CHECK



GUNS AND
HELLDIVERS

GROUND PILOT

Dolly Heberding, here checking a new Navy "Helldiver," was a pilot instructor and flyer for the CAP before she became a "ground pilot."

By GEORGE R. REISS

An experienced pilot, Dolly Heberding is the only woman permitted to ground-test "Helldivers" at Curtiss-Wright.

VISITORS at Port Columbus, the big central Ohio air base, often watch a Curtiss *Helldiver* dive bomber, a big brute of a plane painted in weird colors, taxi out from the Curtiss-Wright plant, fold and unfold its long wings like a bird, run up its single big engine, whirl around in simulated ground loops and go through other ground maneuvers.

And then suddenly their eyes will pop. "Look!", pointing to the white-helmeted figure in the pilot's cockpit. "A woman!"

That will be Dolly Heberding, pretty 23-year-old Curtiss-Wright flight inspector, the only woman entrusted with the complicated cockpits of the costly *Helldivers*, the only woman permitted to start their engines or to operate their wing-folding mechanism.

The Curtiss-Wright Columbus plant employs 10,000 or more women, and Dolly is the envy of them all, as well as the envy of many of the thousands of male workers, too; for all the aircraft workers trudge steadfastly at their work-a-day jobs, nursing secret dreams of really climbing into the cockpits of their finished product and operating them.

Dolly's job is putting the big brutes through their pre-flight tests, checking the propellers and controls, the engines and flaps, bomb bay mechanism, magnetos —anything that possibly could go wrong —and then whirling them around the field to determine if the landing gear will hold up.

But she also nurses a dream—that of taking the gawky jobs up and putting them through aerobatics and test dives, for she is a skilled pilot, a former flying instructor, and she feels the same way about running the planes on the ground and never flying them as most girls feel about the advertising catch line "many

(*Continued on page* 122)

JUNGLE *Emergencies*

"Jungle Emergencies," from which this article is derived, is the title of another in the series of lively authoritative booklets written by the Safety Education and Air Traffic and Safety sections, AAF, to help airmen forced down in unfamiliar areas of the earth. Other booklets include "Arctic Emergencies" (FLYING, February, 1944) and "Desert Emergencies," to be published in a future issue of FLYING. The booklets have buttoned-over covers to protect and make them easier to carry. They are well-illustrated with drawings of edible and poisonous plants and diagrams explaining how to survive in strange environments.—Ed.

IF YOU land your plane in a clearing, plan to stay with it a few days. If you crash-land in trees, camp near the wreckage temporarily. If you were following your normal flight course, your plane will be easier to locate than you will be.

In a multi-place plane, good quarters can be set up inside the plane by covering the door and cockpit openings with mosquito netting or parachutes.

If your plane is intact and there is some chance that you may be able to fly it out, your first job is to secure it by digging hub-deep holes for the landing wheels and staking down wings and tail.

Your second job is to attempt to establish radio contact and set up signals. Place bright-colored or reflecting objects on the wings and around the plane. Cowl panels placed upside-down form good reflectors. Line them up side-by-side on the wings where they can reflect the sun.

BAILING OUT?

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The airplane will provide shelter.

Residual fuel and oil can be drained and burned for warmth and to supply smoke or signals.

Material will be available for improvised sun helmets, fish spears, shelter, bush knives, signalling devices, etc.

If, however, it is necessary to bail out, you should attempt to:

Tuck your maps and emergency rations inside your clothes.

Make your way to the wrecked airplane if it is not too far away.

Prepare some sort of signalling device for instant use.

General suggestions:

Wear, or carry with you, appropriate clothing.

Wear shoes that you can walk home in.

Lay several fires within a few hundred feet of the plane, so they can be lighted when a rescue plane is sighted. Place a small can of engine oil and a can of water near one of the fires. Engine oil thrown on a fire will produce black smoke, water will send up billows of steam.

Do everything you can to make the plane stand out against its background. Orange life-preserver cushions are good for this purpose. If you have an emergency kit or a life-raft kit, use the large yellow-and-blue panel to signal.

Divide general duties among your crew. It will help prevent fears and panic. Post a guard every night. If you are not within, or dangerously near, enemy-held territory, keep a signal fire going continuously. This will conserve your signal-pistol ammunition or flares.

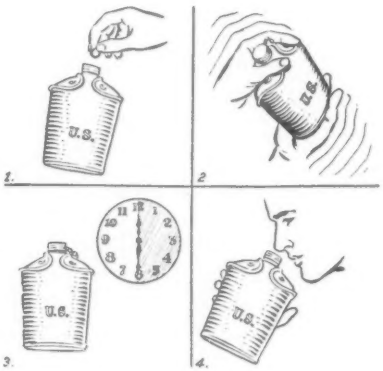
Fix your location by compass, octant or the stars. Make scouting trips in search of streams, making sure to mark a trail in the form of knife cuts on trees, bent branches, arrows, or bits of paper or cloth. It is very easy to roam in circles in thick forest or jungle.

If you find a stream, make careful note of its direction and position from your camp. It may lead you to civilization if you start to walk out.

If you can't locate a stream for drinking water, dig a hole in the lowest depression near your camp. If you don't strike water down three or four feet, try another spot. Unless you are on high ground, water should be located in a few trys.

Animal trails will eventually lead you to water. With few exceptions, all animals travel towards water at dawn and dusk.

Warning: All water for drinking must be purified either by boiling for three minutes or by treatment with Halazone tablets. Although not as effective as Halazone, tincture of iodine can be used as an emergency water purifier. Add three drops of iodine to each quart of water, previously boiled and cooled. Stir the water thoroughly and allow to stand for 30 minutes before drinking.



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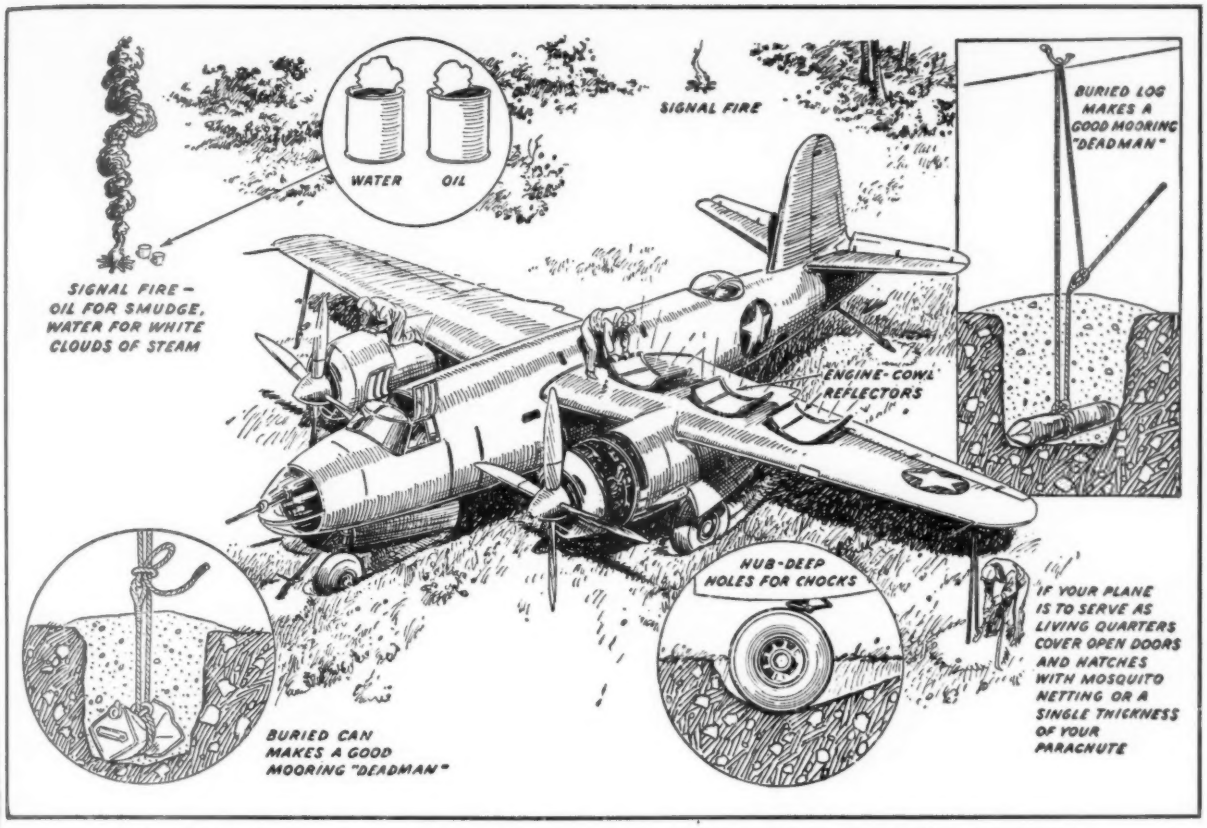
WATER
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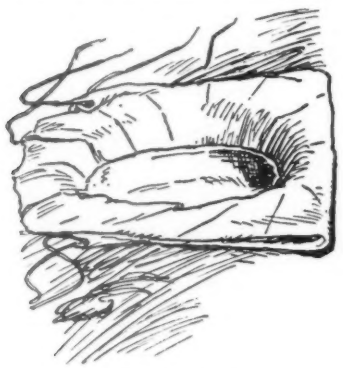

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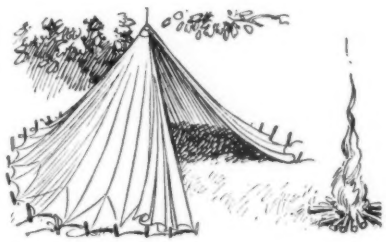

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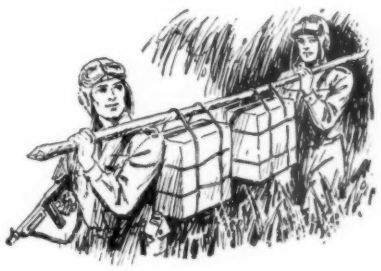

If you are traveling as a group, take your life rafts. They can often be used for transporting equipment if not yourselves. Two men can carry them swung on poles.

Before leaving your plane, burn all papers, technical orders and trip data that might be restricted, confidential or classified. Secret instruments should be smashed and the parts buried. If you are

(*Continued on page* 88)

JUNGLE *Emergencies*

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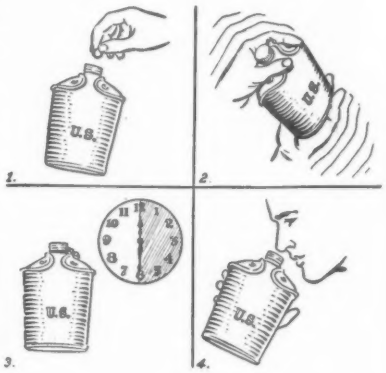

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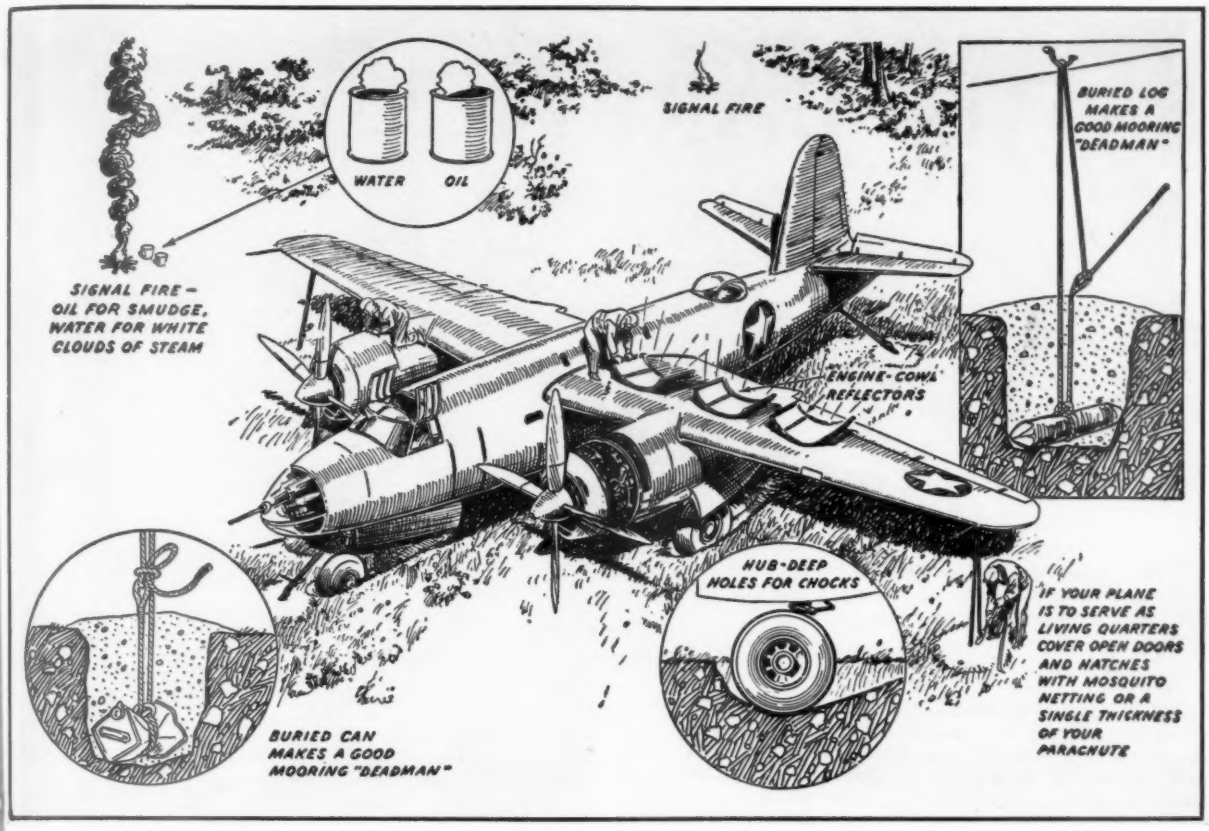
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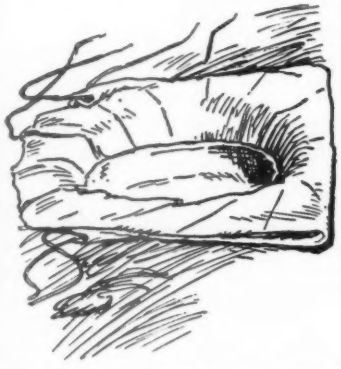

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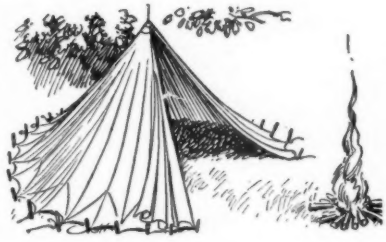
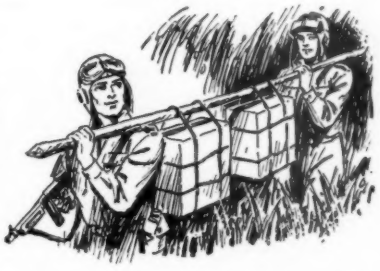


Wet clothing should be changed for dry as soon as practicable. If you have no change of clothing, build a fire, strip, rub your body, arms, and legs vigorously to dry them and increase the circulation of your blood. Remain naked until your clothes dry.

Avoid tight-fitting clothing. Cotton shirts are better than wool, cooler and more resistant to snagging and fungus rot. Gloves will protect your hands against burrs, nettles and mosquitoes.



If you are traveling as a group, take your life rafts. They can often be used for transporting equipment if not yourselves. Two men can carry them swung on poles.

Before leaving your plane, burn all papers, technical orders and trip data that might be restricted, confidential or classified. Secret instruments should be smashed and the parts buried. If you are

(*Continued on page* 88)

The BARRACUDA

The pilot's cockpit gives him excellent visibility, particularly for carrier operations.

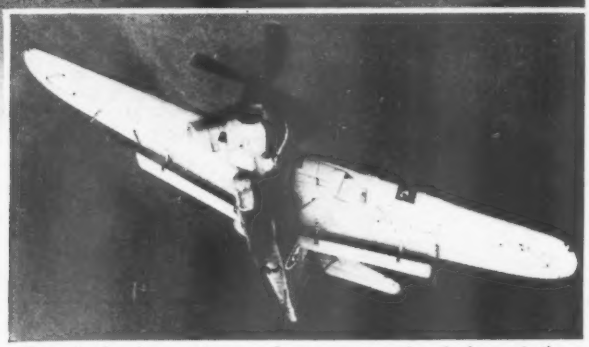
BRITAIN'S latest carrier-based torpedo plane is a product of the Fairey company, the British firm responsible for the famed *Swordfish* and *Albacore* torpedo planes, and for the *Fulmar* carrier-based fighter. Many of the lines of the *Fulmar* can be seen in the *Barracuda*.

First official mention of the *Barracuda* came recently, after several of these hitherto secret torpedo planes fell to the Germans in Norway during the torpedo attack on the German battleship *Tirpitz*. Prior to this operation, however, the *Barracuda* had been operating aboard British carriers for some time.

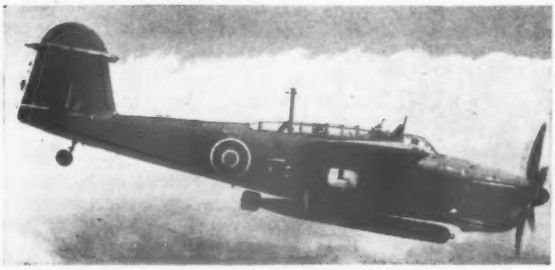
A high mid-wing monoplane, the *Barracuda* is powered with a Rolls-Royce *Merlin* engine. The crew is made up of the pilot, observer and radioman-gunner. An excellent photographic platform, the *Barracuda* has large windows in the fuselage under the wing (see the photograph directly below).

A single torpedo can be carried externally. The *Barracuda* also can carry bombs and mines. No armament details have been released.

The *Barracuda* is notable for its un-aerodynamic appearance. A large flap hangs permanently to the underside of the wing. The externally-hung torpedo slows down the airplane considerably. The variety of other protuberances, from air flow deflection vanes to the fixed tail wheel, slow the plane even more. The horizontal tail surfaces are braced high on the vertical surfaces to keep out of the area blanketed by the wing and flap. These photographs were taken for FLYING by Charles E. Brown of London. END



Torpedo, bombs or mines are hung on external racks beneath the fuselage. The Rolls-Royce Merlin engine develops about 1,300 h.p.



The large bulging windows in the fuselage are excellent for reconnaissance. Fuselage length is approximately 39 feet.

Many Fulmar features are visible here: short-span (49 feet) tapered wing, tail unit and retractable wheels. Note carrier hook.

Young men, such as these Martin employees routing wing sections, are first draft choice.

☆

YOUR DRAFT STATUS

By CHARLES WILSON

Heavily staffed with young men, aviation must expect deep inroads by the draft.

WHAT is the effect of present selective service regulations on these under-26-years-of-age key employees of the commercial airlines and the aircraft production industry: flight personnel—1,600-odd; maintenance personnel — 2,000-odd; engineering personnel—5,000-odd?

The answer to this question may determine the ability of transport companies to continue operations on a scale in keeping with their amazing wartime records and of the aircraft producers to continue their tremendous monthly output.

To seek the answer is to become enmeshed in an inscrutable maze of manpower red tape.

Air transport and aircraft manufacturing executives, like their counterparts elsewhere in the war program, have been mildly confused by selective service regulations ever since the inception of conscription, never knowing how long they could expect to hold on to "essential" employees.

But this mild confusion, taken in good spirit on the assumption it was unavoidable in such a mammoth military undertaking as this country was embarked upon, gave way to utter bewilderment late in February—and since then war production and transport directors have wandered about in a labyrinthine structure of manpower controls.

It was in February that President Roosevelt ordered a review of 5,000,000 occupational deferments in all age brackets, and there followed a series of developments in the manpower control system which had the employers and their employees alternating between cold sweats and feverish temperatures, until finally one Washington correspondent was moved to report: "There's not a draft-age man in the country who can tell you at this minute where he stands."

First, deferments were outlawed for 18- to 21-year-olds. Then neither age nor fatherhood mattered one iota. Then the 18 to 26 category got the spotlight and fatherhood didn't matter. Then men over 26 and especially fathers were granted liberal deferments. Then strict deferment policies were applied to those betwen 26 and 29. Then induction of all men over 25 in essential occupations was stopped. These were a few of the developments in recent months which gave rise to the correspondent's statement.

After months of inter-departmental, government-industry and other types of negotiation and manipulation, however, certain facts now are clear. Selective Service is operating progressively within various age groups. It can be said, without straying too far from truth, that anyone under 26 years is headed directly to the Army or Navy unless he is physically unacceptable. Those between 26 and 29 are scarcely less vulnerable. The exceptions will be noted momentarily, but the essential fact is that local boards, flooded with new regulations, are concerned primarily with meeting one goal—that of filling their quotas. Young, 1-A material accordingly will do well to pay not too much attention to the elaborate procedures set up for obtaining deferments.

This is no attempt to criticize the selective service system or the military services for their desire to draft all men, able bodied, under 26—and eventually all under 30. It rather represents an endeavor to point to the possible effects of the new conscription rules with respect to air transport and aircraft production.

The question of whether a man contributes more to the war effort on the production lines than in uniform appears in general to have been settled in the negative, and yet the Secretary of War, Secretary of the Navy and the Maritime Commission Chairman, can report that:

Recapitulation of Airline Personnel in Key Positions Under 22 and Between Ages 22-26

Under 22

Flight Personnel						Maintenance Personnel									
CAPT	COP	RAD	ENG	NAV	TOTAL	FR	CC	IN	SM	LM	ME	JM	AM	MT	TOTAL
1	34	103	42	7	187	2	5	6	23	11	147	85	133	11	423

Ages 22-26

182	809	236	132	75	1434	13	54	79	161	60	726	258	162	60	1575

Key: CAPT—Captain, COP—CoPilot, RAD—Radio Operator, ENG—Engineer, NAV—Navigator

Key: FR—Foreman, CC—Crewchief, IN—Inspector, SM—Senior Mechanic, LM—Lead Mechanic

Key: ME—Mechanic, JM—Junior Mechanic, AM—Apprentice Mechanic, MT—Meteorologist

MAINTENANCE PERSONNEL

	Under 22									22 to 26									
	FR	CC	IN	SM	LM	ME	JM	AM	MT	FR	CC	IN	SM	LM	ME	JM	AM	MT	TOTAL
AA	1	0	0	0	0	66	52	0	2	0	0	1	3	16	173	43	0	6	363
AAA	0	0	0	0	0	2	1	10	0	4	0	0	8	0	10	0	0	0	35
BMF	0	0	0	0	0	0	0	8	0	0	2	2	0	0	39	0	11	0	62
CHI	0	0	1	4	0	2	0	12	0	0	3	3	11	0	7	0	6	0	49
COL	0	0	0	1	0	2	2	3	0	0	1	2	5	2	2	3	5	1	29
CAL	0	0	0	0	0	1	0	0	0	0	1	0	0	0	2	2	0	1	9
DAL	0	0	0	2	0	0	0	1	0	0	0	1	10	0	11	0	5	0	30
EAL	0	0	0	1	0	5	0	8	0	0	1	3	12	7	60	0	15	7	119
INL	0	0	0	0	0	0	1	4	0	0	2	2	5	0	6	1	0	0	21
MCA	0	0	0	0	0	0	0	9	0	0	0	4	9	0	13	0	11	0	46
NAL	0	0	1	0	0	0	0	5	0	0	0	5	5	3	0	11	6	0	36
NEA	0	0	0	5	2	0	0	5	0	2	7	0	15	10	0	4	6	0	56
NWA	1	5	4	4	0	32	0	44	0	5	19	12	4	8	92	0	39	2	271
PAA	0	0	0	1	9	0	0	9	3	0	11	18	35	0	107	48	0	15	256
PANAGRA	0	0	0	0	0	0	0	0	3	0	3	0	0	0	1	0	0	7	14
PCA	0	0	0	4	0	15	0	1	0	2	0	4	13	7	37	0	6	3	92
TWA	0	0	0	1	0	14	7	1	0	0	3	20	32	0	82	39	5	6	210
UAL	0	0	0	0	0	7	20	10	3	0	1	1	2	3	73	100	31	12	263
WAL	0	0	0	0	0	1	2	3	0	0	0	1	2	4	11	7	6	0	37
TOTAL	2	5	6	23	11	147	85	133	11	13	54	79	161	60	726	258	162	60	1998

Key: FR—Foreman; CC—Crewchief; IN—Inspector; SM—Senior Mechanic; LM—Lead Mechanic; ME—Mechanic; JM—Junior Mechanic; AM—Apprentice Mechanic; MT—Meteorologist.

FLIGHT PERSONNEL

	Under 22					22 to 26					
	CAPT	COP	RAD	ENG	NAV	CAPT	COP	RAD	ENG	NAV	TOTAL
AA	0	5	16	27	1	14	83	20	58	23	247
AAA	0	0	0	5	0	0	0	0	2	0	7
BNF	0	2	0	0	0	18	37	0	0	0	57
CHI	0	1	5	0	0	7	13	1	2	0	29
COL	0	0	0	0	0	2	6	0	0	0	8
CAL	1	0	0	0	0	0	5	5	0	0	11
DAL	0	0	0	0	0	5	8	4	0	0	17
EAL	0	1	1	0	0	2	54	17	0	5	80
INL	0	0	0	0	0	5	6	0	0	0	11
MCA	0	0	0	0	0	7	14	0	0	0	21
NAL	0	0	0	0	0	2	3	0	0	0	5
NEA	0	1	0	0	0	3	12	6	1	0	23
NWA	0	7	0	0	0	29	53	0	0	0	89
PAA	0	6	49	9	1	40	130	95	40	15	385
PANAGRA	0	2	3	0	0	9	34	19	0	0	67
PCA	0	2	0	0	0	8	16	0	0	0	26
TWA	0	4	12	1	2	12	96	23	22	9	181
UAL	0	3	15	0	3	10	219	46	7	23	326
WAL	0	0	2	0	0	9	20	0	0	0	31
TOTAL	1	34	103	42	7	182	809	236	132	75	1621

Key: CAPT—Captain; COP—CoPilot; RAD—Radio Operator; ENG—Engineer; NAV—Navigator

This is a breakdown of draft-age airline male personnel.

"The aircraft plants and the shipyards must not only be provided replacements for men called into the armed forces, but they must be given 200,000 additional workers to supply the demand for planes and ships."

It would seem then, at first blush, that a blanket deferment for the few thousand key employees in the 18-26 group connected with aviation—by no means all the aviation personnel in that age category—would have no appreciable effect on an army which Stimson says can miscalculate its strength by 100,000 and still be making only a two per cent error.

But there happens to be a dozen other activities rated in varying degrees of essentiality along with aviation. As the invasion approached, bringing with it the crucial phase of the war, the need for young men, strictly for combat replacements, became acute, and the decision was made by the top command that each deferment would be meted out only after the most meticulous consideration of the applicant's qualifications.

Employees in the following aviation "must" programs are *eligible* for deferment consideration: Group I-IV aircraft, aircraft carriers, aircraft maintenance including modification centers, aviation gasoline, flight personnel, and ground personnel *outside* the United States.

Being eligible for deferment and obtaining it, however, are not quite similar. It now appears that perhaps 90,000 to 100,000 key individuals may obtain deferments, this figure representing the allotment to all the war programs included in the new draft rules. Half or more will be merchant mariners, leaving a small kitty to divide among the remaining essential occupations.

About all that can be said is that air transport and aircraft production will receive as favorable if not more favorable consideration than other wartime essentials.

Both transport and manufacturing industries have powerful representation in Washington in the person of Gen. H. H. Arnold, head of the Army Air Forces. Although aircraft production leveled off some after the peak month of March, there is optimism that production goals which may be set from month to month will be met. The Air Transport Command, for which the commercial airlines operate under contract, likewise is a top-ranking priority enterprise and will not be permitted to suffer too great losses of manpower.

Balancing these factors somewhat are the youth of the aviation industry in general which makes its personnel more vulnerable, and the assiduous manner in which local boards are lapping up youthful Army-Navy eligibles.

A counter-balancing factor that should be suggested is the likelihood that should local boards too greatly ignore deferment requests, we may see a considerable number of Army enlisted reserves among ground crews and engineers.

It might be useful to survey the air transport manpower pool potentially available to the armed forces. Most recent figures show that at least 25 per cent of flight and skilled maintenance personnel is in the 18 to 26 age bracket, and it must be noted that no provision is made for deferment of maintenance personnel *within* the continent.

Among the flight personnel there are: 183 captains, 843 co-pilots, 339 radio operators, 174 flight engineers and 82 navigators, making a total of 1,621.

Among maintenance personnel there are: 15 foremen, 59 crew chiefs, 85 inspectors, 184 senior mechanics, 71 lead mechanics, 873 mechanics, 343 junior mechanics, 295 apprentice mechanics and 71 meteorologists, making a total of 1,998.

A more complex picture is presented in the production end of aviation. The engineering personnel, aged 18 to 25 inclusive, in a group of west coast plants, totals 3,088 or 30.3 percent. Some of these, presumably, are classified 4-F.

East Coast companies affiliated with the National Aircraft War Production Council report a total of 1,908 employees in critical engineering occupations, or 30.6 per cent, exclusive of 4-F's. These occupations include design and drafting, computation and analyses, testing and technical co-ordination. The Council says that a denial of deferments to these employees would make it "impossible" to complete presently scheduled design work.

Government spokesmen say about four out of five employees in deferrable occupations may be called for induction, and perhaps 60 per cent of these will pass physical tests.

It thus becomes apparent that radical adjustments may have to be made in both the aviation transport and production industries. END

Smithsonian

The other day we paid a visit to Smithsonian Institution and its secretary, Dr. C. G. Abbot, and came away with two startling facts.

The first fact is that Smithsonian has the best aviation collection of any museum in the world.

The second fact is that, everything considered, the collection is also the world's worst.

Nobody is more acutely conscious of these facts than Dr. Abbot. Better than any other man, he knows why the aviation collection outranks any other, and more than any other man he is acutely conscious of its limitations.

It is largely a limitation of quarters. The collection is housed today under two roofs. Some of the rarest items—like Wiley Post's *Winnie Mae*—hang from the ceiling of the Arts and Industries Building, a red brick structure built in 1879 and also housing a miscellany of collections, including the horse and buggy, stamps, various kinds of trains and street cars, and the party dresses worn by the wives of the presidents. The rest of the aviation pieces are crowded into what is eupheumistically called the Aircraft Building, a hangar-like structure of corrugated iron in Arts and Industries' back yard. Aircraft was built in 1917 to house wartime office workers and Smithsonian took it over after the Armistice.

The collection is excellent as far as it goes because of the experts who have assembled it. Samuel Pierpont Langley did most of his aviation pioneering while he was secretary of Smithsonian, and the collection is therefore rich in relics of his work. Late one chill afternoon in December, 1903, a second attempt was made to fly the Langley aerodrome from the deck of a houseboat on the Potomac and, watching through a four-inch telescope from one of the red-brick towers of the Institution, was a young man named C. G. Abbot. He has been watching aviation with the same intense interest since. His most recent achievement was to bury the misunderstandings between Smithsonian and the Wright brothers over their first flight and arrange for the post-war return of the Wright Kitty Hawk model from England to Smithsonian.

Since becoming the head of Smithsonian he has also had the advice and expert aid of Paul Edward Garber, an ex-airmail pilot and assistant curator of engineering now on leave to the Navy. Between them, they have made the collection as it stands today the best in the world.

But to the wartime eye of a modern American—man, woman, or boy—it is a strange collection indeed. Combat planes from the last war and some of the first record-breakers of the twenties are found in the Aircraft Building, and there are small models of such bat-like beauties as Leonardo da Vinci's one-man job of 1490, Henson's proposed airliner of 1842 and the Lilienthal glider of 1894.

This is a proud collection—the most extensive in the world. It outranks anything else in this country—including those at New York, Philadelphia, and Chicago—and before the war outranked one near Paris and another at Munich. It would seem fair to assume that these last will not be in the running post-war, if they are even in existence.

But the amazing thing about looking at Smithsonian through aviation eyes is that the present collection is muted, mangled and badly displayed, and that the visitor has to keep reminding himself that there is a war on. There is no way of knowing that in the last 10 years we have established, once and for all, that we are the greatest aviation nation in the world, the greatest builders of aircraft. The impression one brings away is that we patted Wiley Post, Lindbergh and the other distance-flight boys on the back, racked up their planes and returned to contemplating the horse and buggy.

There is, of course, a reason why this is temporarily true. Army, Navy, the industry and manpower are at war. Planes, engines, and equipment are available. Indeed, Dr. Abbot is almost daily embarrassed by someone in the industry offering to send along a battle-scarred World War II plane for exhibition. Smithsonian, understandably, hasn't the room and there isn't the manpower and material to build additional quarters.

But at this writing there are no plans crystallized whereby quarters will be available, post-war. For a decade, Smithsonian officials have been pointing this out to no avail. Their most recent proposal was to the National Resources Planning Board (shortly before that Board folded) for $25,000,000 in post-war building funds, some $10,000,000 of which was to be used for a new Arts and Industries building. It should be emphasized that the appropriation was not for a new and separate aviation building. The plans called for an extension of the present horse-car-under-the-airplane's-wings arrangement.

With America established as a world leader, if not *the* world leader, in the air, and with our aircraft builders undoubtedly the most efficient and productive in history, this would seem a paradox that deserves the attention of Congress. Plans should be made now for giving aviation the prominence it deserves if for no other reason than that the youth of the nation, who make a beeline for Smithsonian the minute they reach Washington, may come away thoroughly enlightened and inspired, instead of bewildered and disappointed.

Fish Story

We thought we had a third candidate for the Loyal Order of Gremlins the other day, but we've checked the facts carefully with the Office of the Co-ordinator of Inter-American Affairs, source of the news, and find that it is unadulterated truth.

It concerns the Caribbean Fishery Mission, which has just completed the first extensive fishery survey using the air as a basic means of transportation. A total of 25,000 miles of the survey was conducted in transports. Surface vehicles, including schooners, sloops, trains, gascars, automobiles, dugout canoes, oxcarts and horses, contributed a total of only 5,000 miles.

The survey covered an area of 800,000 square miles in which about 95,000 commercial fishermen and 30,000 boats operate. The Rockefeller Committee and the Fish and Wildlife Service of the Interior Department sponsored the work, resulting in findings which are being used to increase the catch of fishermen in the area and, post-war, will be invaluable to sports fishermen in search of a prize tuna or swordfish. Indeed, the Mission reports that the pelagic species of fish—migratories existing near the ocean surface, such as tuna, swordfish and Spanish mackerel—"offer, both inshore and offshore, the greatest possibilities for fishery development in the Caribbean."

Second Front

Every once in a while Gen. H. H. Arnold says something about what's going on in the air over Europe. It's a subject so obviously close to his heart that you might forgive him for getting oratorical. He doesn't orate. He might

(*Continued on page* 130)

FACTORY MEDICO

Clinical section of a Curtiss-Wright hospital in New York State treats slight injuries to reduce amount of infection.

By FREDRIC SINCLAIR

By handling 5,000 patients per week, the medical division of Curtiss-Wright's New York State plants reduces man-days lost through illness.

SOMETHING was happening to his face. His excitement and the heat of the radiator the doctor had maneuvered him to were combining to conspire against him. Tiny, livid blemishes were erupting on his face. The madder he got the quicker they popped out—spreading fast—mottling his face.

The doctor watched with interest, tapping a pencil against his teeth. "You're going to be plastered with them in another hour," he observed dryly. He thumbed a push-button under his desk and a nurse entered the office. The doctor nodded at the speckle-faced young man. "Isolation case, Miss Robinson," said the doctor. "Sorry, my boy, you've a fine case of measles."

The nurse firmly marched the young service representative out of the office.

This happened at 8:10 in the morning. The doctor's day officially began at 8:30. But by 8:30 he had already talked to three more patients, inspected some new equipment, checked X-ray photos of an injured rib and had smoked in the neighborhood of 10 cigarettes. By 8:30 he was in high gear.

He's a dynamo, this young factory medico, Dr. Stuart A. Good, M.D., medical director of the Curtiss-Wright Corporation, Airplane Division, New York State plants. His capacity for work is amazing. He combines the qualities of an astute practitioner and a diagnostician into one 200-pound package of energy and dynamite and keeps it capped under a bland face, a mild voice and affable eyes.

He handles quite a job. As head physician of the New York State plants his patients number about 40,000 men and women war workers. The medical staff handles on an average of 5,000 patients each week, whose injuries and illnesses range from simple cuts and bruises to amputations, from measles to dermatitis.

He supervises the hospitals and clinics of the plants, guides the purchasing of all medicinal and surgical equipment and personally looks in on many of the cases that pass through the hospital daily.

The Curtiss medical department enjoys an enviable record in cost maintenance. Based on tabulations released by the National Compensation Board, which figures medical cost per employee for all industries employing more than 1,000 workers, the Curtiss medical department's compensation expenditure for the year of 1942 is about $2.50 below the national average.

It's the medical department's job to check the sanitation, ventilation and general hygiene of the plants. Members of the staff make frequent trips through the shops on the lookout for hazards to life and limb of war workers, checking various danger points on many of the production machines. They pass on their suggestions to the safety committee of the plants and Dr. Good quietly rechecks the following week to see if they've been carried out. He's not so quiet if they haven't been.

Touring the kitchens and cafeterias the medical staff's eyes are alert and quick to spot any unclean dishes or si-

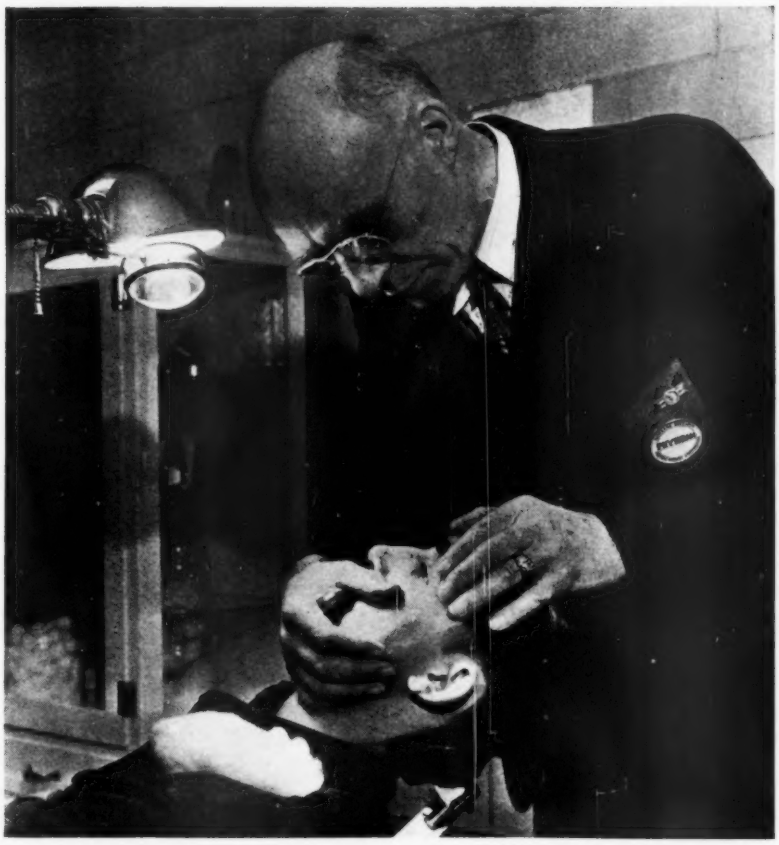
Dr. Stuart A. Good.

verware that might slip through the vigilant hands of the kitchen help. Dr. Good makes a fetish of cleanliness. "Dirt breeds germs and germs breed disease and disease kills people," he quotes a schoolboy's parable. "Or makes 'em pretty damn sick," he adds.

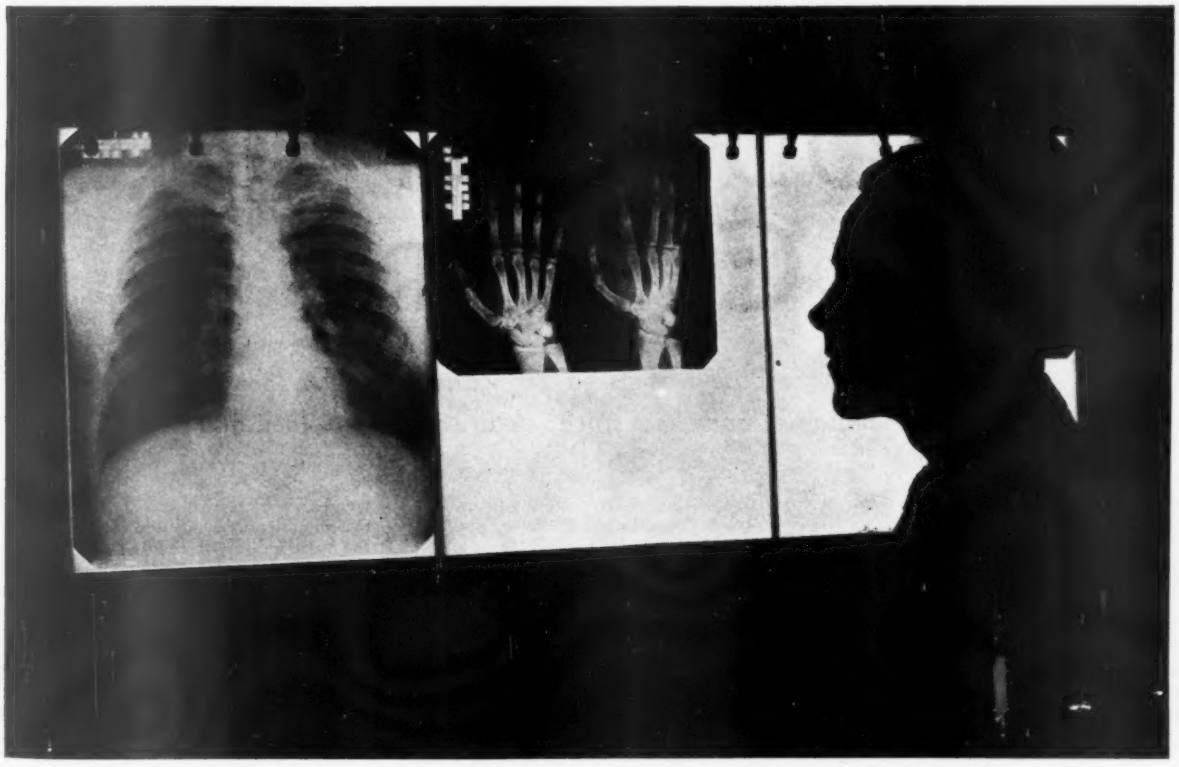
A great believer in the maintained health of the war workers, Dr. Good was responsible for the concentrated vitamin drive that extended into a steady feature in the plants. He also instigated the sale of cold vaccine tablets in the plants, whereby through proper dosage the war workers are immunized to a certain degree from that great bugaboo—the common cold.

Medical authorities have estimated that head colds are responsible for the bulk of absentees in industry. The time off ranges from a half day to three days. Over a period of time, these days lost

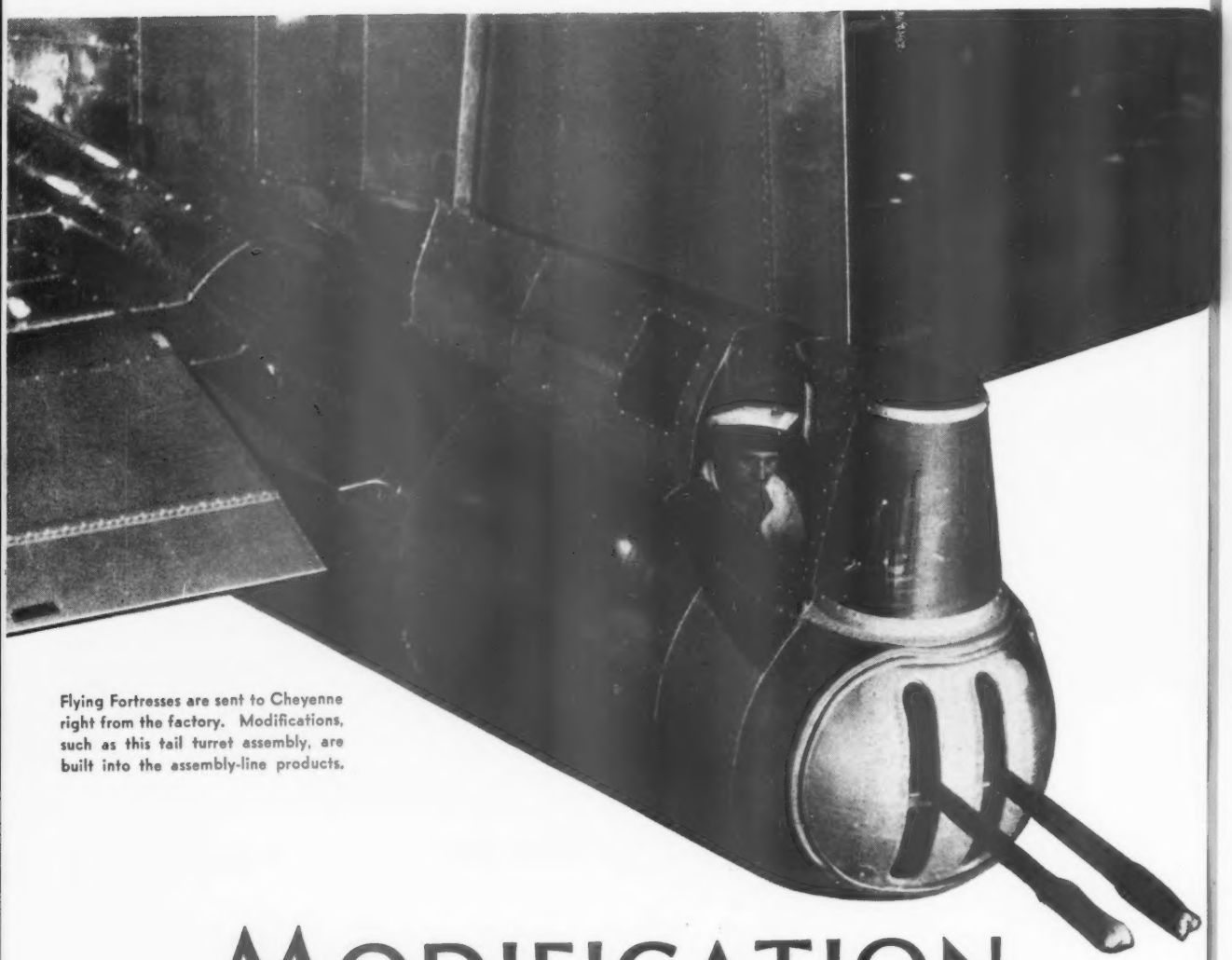
(*Continued on page* 94)



Eye injuries are major cause of lost manhours. Here, Dr. George Fisk examines patient.



X-ray prints of Curtiss-Wright workers. Two X-ray technicians assist 42 nurses and 11 doctors to provide 24-hour service.



Flying Fortresses are sent to Cheyenne right from the factory. Modifications, such as this tail turret assembly, are built into the assembly-line products.

MODIFICATION CENTER

UAL's Cheyenne base was asked to modify two Forts. Soon it was in business, and has since modified several thousand.

FORTY years ago, Cheyenne, Wyo., was a typical western cow town with a population of 14,000. In later years it was headquarters for United Air Lines' major maintenance base.

Today, in place of the whoops and hollers of Indians and rootin', tootin' cowboys, the air around the town is filled with the roar of four-engined bombers, noise of riveting guns, clanking of sheet-metal work, and all the other sounds which go with a modern war plant. Now the town's population is more than 44,000.

Largely responsible for the transformation has been United Air Lines' modification center, devoted solely to modifying and building parts for AAF *Flying Fortresses.* United has modified several thousand *Forts* and has manufactured more than 4,000,000 parts used in them.

It all started in January, 1942. One wintry day, when the mercury was 30° "down under," W. P. Hoare, superintendent of United's Cheyenne base, received a telegram from the Army Air Forces Materiel Command stating that two *Fortresses* were about to be sent to Cheyenne for modification. Could United handle the work?

The Air Forces explained that these planes were to be used on a photographic mission and needed camera installations plus additional fuel tanks for long range flying. War plants still were flooded with the terrific blast of work set off by Pearl Harbor and couldn't do the job quickly enough. The Materiel Command turned to the well-equipped airline.

United complied by telephone and the

Modification ideas often come from returned bomber crews. Here two pilots of plane, "Hell's Angels," confer with United engineers.

planes soon arrived. Almost simultaneously came two civilian representatives from the Army and an engineer from the Boeing Aircraft Company at Seattle. The Air Force representatives brought huge aerial cameras; the Boeing engineer data on how much additional load the *Fortresses* could stand.

No blueprints were forwarded for this first job. Three holes, each approximately 14 inches in diameter, had to be cut in the bottom of each plane's nose; three weighty cameras mounted so that the lenses would fit perfectly into the holes; additional fuel tanks installed on built-in cradles within the fuselages—all without designs or specifications.

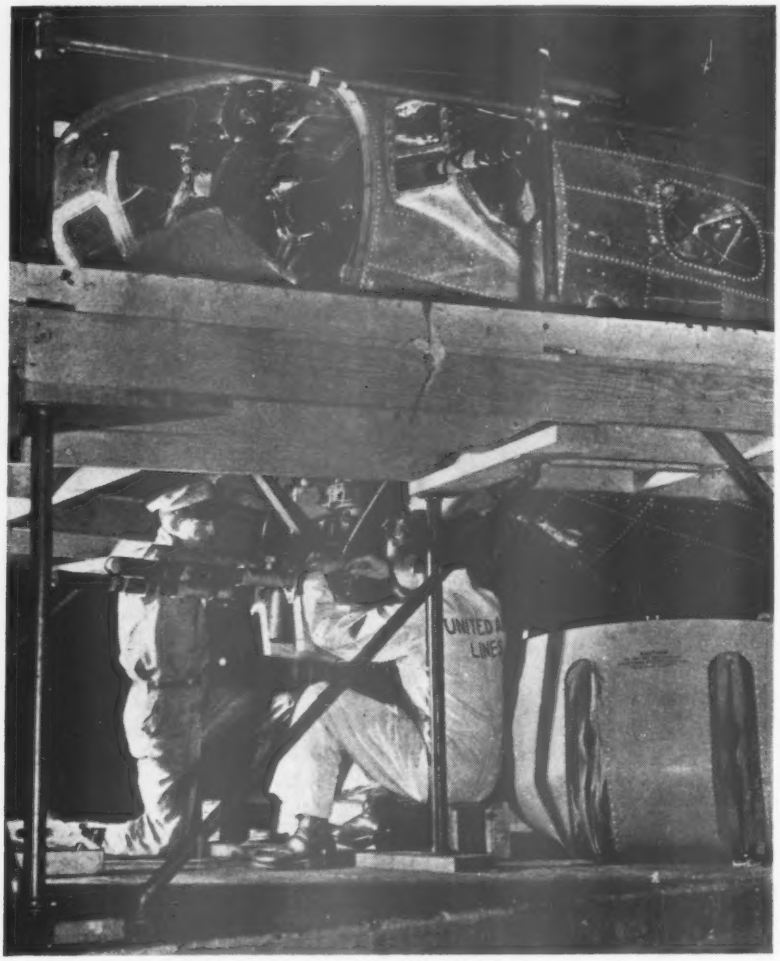
Noses of the planes were held by manpower while mechanics cut the necessary holes. Make-shift mounts and supports were built in to hold the cameras firmly in position. With the installation of modified Douglas DC-3 wing-tanks, the fuel loads and cruising range of the bombers were increased substantially.

Work on those two planes was accomplished in 30 days by 30 men, directed by Don Stombaugh, then United's foreman in charge of the sheet-metal shop, now assistant superintendent of the modification center. The company had to move its own planes out of the main hangar.

It apparently was worth all the effort because it later was learned that one of the planes was used to take the first aerial photographs of war-time Japan.

That was the first job and, at the time, United's personnel believed it would be

Operations at Cheyenne have gotten on a factory production basis. Drop hammer operators stamp out metal fittings for tail turrets to be installed on Forts.



Chin turret assembly was developed and produced by United's engineers in early days of Cheyenne center. It is now being manufactured at the factories making the Forts.

the one and only. But in March, after two additional "projects" had been completed, the company began to realize it really had entered the modification business on a big scale.

Just as work on the first two planes was in the final stage, word came that seven more planes were on the way—this time for the British.

Lou Long, who has been with United's engineering department since 1937, had been on loan to the Materiel Command as a co-ordinator in the Government Furnished Equipment Branch of Production Engineering Division at Wright Field. He was instructed to report to Cheyenne to supervise future modification work.

In mid-February the *Forts* arrived. Again it was a case of no blueprints, no designs and no specifications—this time not even a Boeing engineer or Air Forces representative. Orders read to convert the planes to accommodate the British bombsight (which is shaped different from ours), to change the instruments and other measuring devices so they could be read in British units as well as American, to revamp the electrical system and wiring to suit British radio installations, to install racks and chutes to fit British flares and drift recorders, and to install special bomb racks and electrical solenoids for fusing British bombs.

February in Cheyenne is cold and working on planes out-of-doors isn't fun. United had no hangar space for the new arrivals and, although crews occasionally did work on one plane at a time indoors, the arrangement was much too slow. The engineers still thought plane-modification at Cheyenne was somewhat of a war-time freak and they made no immediate plans for future permanent hangars. Instead, they constructed a temporary lean-to against the leeward side of the main hangar. This was built at right-angles to the

(*Continued on page* 114)

Size of hangar can be judged by parts of nine Fortresses shown here. The mobile servicing platform in foreground is attached to the plane before it enters hangar and, traveling on skids, remains with plane throughout modification.

Model room of National Inventors' Council, where the models submitted to the council are stored.

INVENTORS' COUNCIL

By CHARLES E. PLANCK

The 40,000 aeronautical ideas submitted to the Council since 1940 contain many "queeries," but the best are improving U. S. aircraft.

IT IS difficult to write anything about the National Inventors' Council and not yield to the temptation to get down to cases.

But when you do get down to cases in this interesting Government war agency, you find that you can't see the flowers for the crackpots. Take any tack you please and the staff of the Council can produce examples by the score of "queeries".

Here is one of the most practical of our war enterprises, a continuous, searching and probing for ideas that will help to win the war. Yet paradoxically the council deals with more impractical ideas than almost any other.

Col. L. B. Lent is chief engineer of the council and since he is an old timer in aviation his mind leans willingly toward the great mass of ideas aeronautical which have been fed into the mill by engineers and amateurs alike.

He is also bursting with ideas that he cannot discuss. In talking with him, you sense a comparison with a plane, its wheels against the chocks and its motor revving up trying to take off. Secrecy is his chock. He knows of so many good things coming in aviation that he has difficulty not to lift just a corner of the secrecy blanket that covers them.

In the months since the council was founded in August, 1940, it has received 200,000 communications, all of which contained inventions or inventive ideas. The number of these that warranted serious considerations has surprised the members of the council and they ascribe this situation to the fact that the ingenious men of the country, especially its trained engineers, have willingly let their brains go to war. The practical purpose of the council is to uncover ideas under 12 subject headings that will be helpful in winning the war.

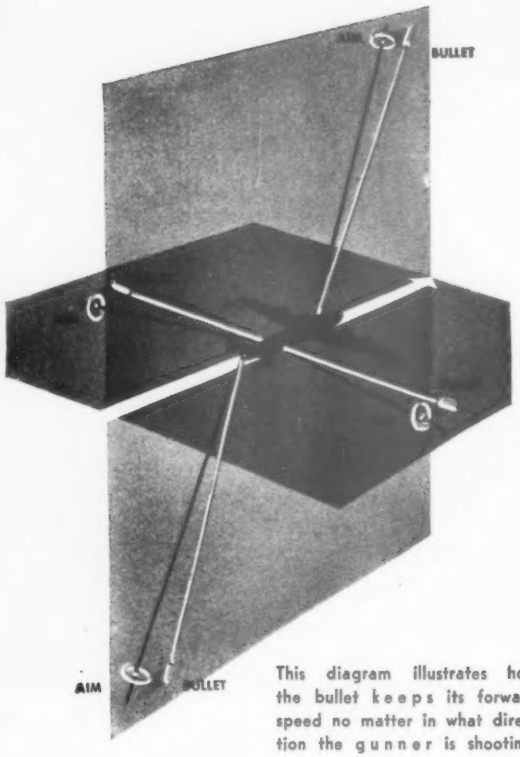
Col. Leon B. Lent, chief engineer of the National Inventors' Council since 1942, learned to fly at Langley Field, Va., in 1917, where he organized the repair shops. He has been an Air Corps reserve officer ever since, has logged 3,000-plus hours. He was general superintendent of U. S. Air Mail Service 1919-21 and is a long-time aviation consultant.

They estimate that five per cent of the ideas submitted are definitely worthwhile

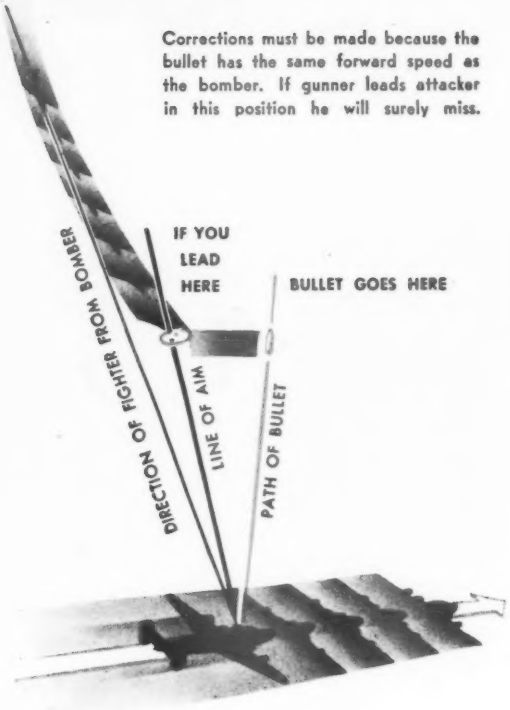
Aeronautics, of course, is one of these headings and 20 per cent of the ideas submitted are concerned with some phase of it. About 40 per cent of them concern the field of ordnance. All other branches of warfare share the remaining 40 per cent. Out of aeronautics' 20 per cent, according to Colonel Lent, have come inventions and ideas destined to be valuable leftovers for civilian flying development when the war ends.

One of the interesting new inventions is a brake for airplanes which military officials regard as better than anything now in use. It is light, especially effective and provides means for dissipating

(*Continued on page* 108)

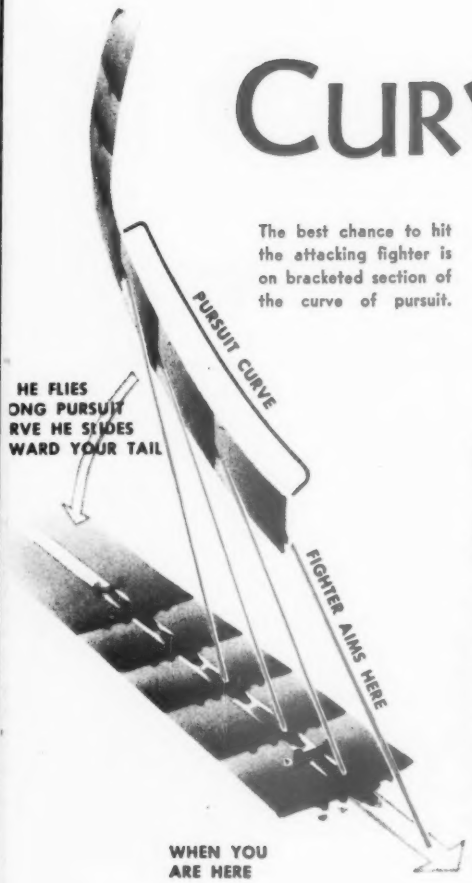


This diagram illustrates how the bullet keeps its forward speed no matter in what direction the gunner is shooting.



Corrections must be made because the bullet has the same forward speed as the bomber. If gunner leads attacker in this position he will surely miss.

CURVE OF PURSUIT



The best chance to hit the attacking fighter is on bracketed section of the curve of pursuit.

By GAITHER LITTRELL

FLYING's Western Editor

New bomber gunnery is based on fact that attacking fighters must approach on a fixed line of flight.

THERE would be a lot more of our airmen alive today — and considerably fewer enemy planes and pilots—if aerial gunners and pursuit pilots at the start of the war had known as much about the theory of gunnery as they do now.

Maj. John D. Eiland, Jr., and Maj. Charlie Falleta, for instance. Both Alabama boys, majors at 26, they are together now at the fixed aerial gunnery school at Williams Field, Chandler, Ariz. Major Falleta has 15 Japs to his credit and Major Eiland three Germans, plus five probables. Their combined number of missions is 175. This is what they say:

"If we'd known then what we know now about aerial gunnery, what a different story it would have been!"

Those are the words of officers who have flown Lockheed *Lightnings* and Bell *Airacobras* against the enemy.

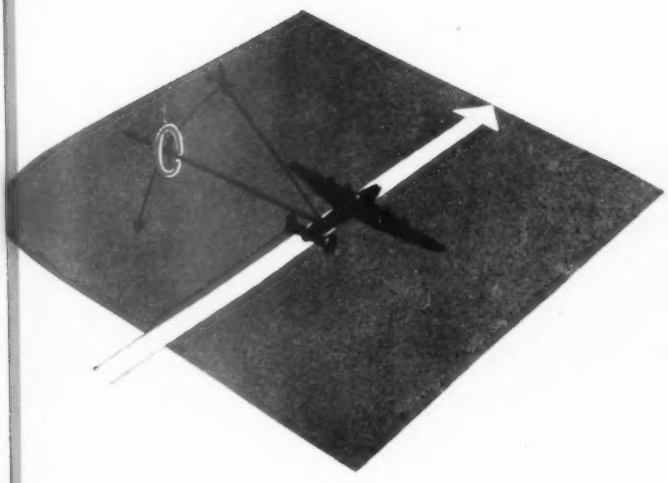
Non-commissioned men have practically the same thing to say:

"Listen! There's nothing like this new technique of aerial gunnery work. If we'd had any of this theory pounded into our heads when war broke out, there'd be a lot fewer Japs and Germans in the air right now!"

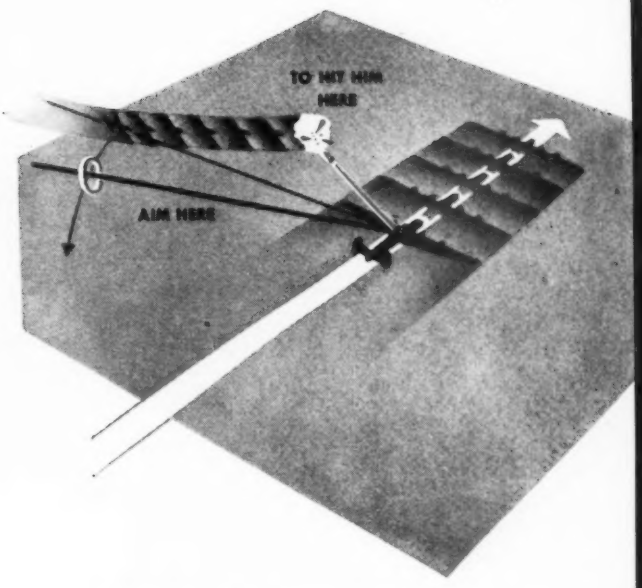
Whether they are at the controls of a fighter plane, pressing spurts of steel into the enemy fighters or bombers, or whether they have their two hands on turret or waist guns protecting their bombers, ours are the world's best gunners.

The reason is because they know a new theory of gunnery.

To start the riddle, how much should an enemy fighter plane, coming at you laterally at 300 m.p.h., be led by your guns if he is 400 yards away and your bomber is traveling in the same direction?



To allow for forward speed and deflection, aim between the attacking plane and your plane's tail. If you lead fighter, you will miss.



When a fighter attacks from the rear, aim below him, as shown here. All deflection shots shown have been corrected for trail.

Don't be too incredulous when you are told that you don't lead him at all—you *trail* him!

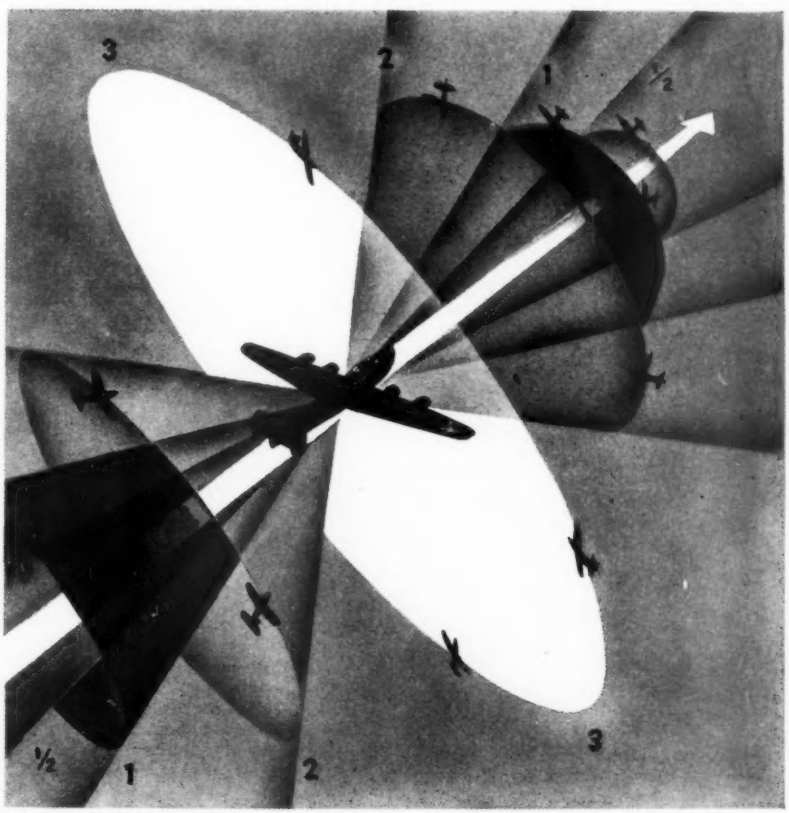
If you don't do exactly that you'll have time to contemplate your mistake while swinging down in your parachute—providing you're one of the lucky ones to get out.

Now, just one more riddle: What is the "curve of pursuit?" Fortunately, our young aerial gunners can answer that.

The curve of pursuit is the line of flight any attacking plane with fixed guns must fly if the attacking pilot wishes to down his foe. Coming in to attack, the fighter must keep aiming at a spot where the attacked plane will be by the time his bullets get there. Therefore, in order to keep aiming at this plane, the attacker must fly in a slight curve. As he flies the curve, the attacker inevitably slides in toward the tail of the attacked plane. If the attacker doesn't fly the curve of pursuit his bullets are wide of the mark.

To give the general public a close-up picture of what our gunners are learning today, Maj. Gen. Ralph Cousins, commanding general of the AAF Western Flying Training Command, Santa Ana, Calif., recently permitted a group of newspaper men and a FLYING representative to tour the gunnery camps of his command.

With only one hour of mental instruction on the new technique of position firing, the writers were placed aboard three Boeing *Flying Fortresses*, taken over the target range and were placed at waist guns—practice guns of .30 caliber—and began firing at a 4x20-foot target towed by an AT-23, a training modification of the Martin *Marauder*.



These gunnery directions go all around your line of flight, forming surfaces of cones from your plane. Give all fighters attacking from cone surface the same amount of deflection.

It was the first time any of these novices had fired a machine gun, yet from a moving plane, one managed to pump 80 shells out of a round of 100 into the moving target at 400 yards! Another got 36 hits, another 29 and the others averaged about 15 apiece.

This with only one hour of *mental* instruction!

That instruction was given by officers under the command of genial Col. Herbert Anderson, commanding officer of the Yuma, Ariz., Army Air Forces Field, where radio operators who have been graduated from radio schools learn to handle guns and double in brass when the going gets rough over enemy territory.

After six weeks at Yuma, these men know as much about gunnery as they do about radio—an invaluable asset when the enemy fighter pilots are swarming in.

gines as the target, the plane was set on the ground 200 yards away. Suddenly its 20-mm. cannon and four .50-caliber nose guns cut loose. The steel engines were practically turned to rubble.

"You've heard that some of the Jap planes we hit seem to disintegrate in the air," Major Falleta said. "Now you see why. When that kind of fire hits them they just fall to pieces!"

At Kingman, Ariz., Col. Harvey P. Huglin is in command. He is "Mr. Brains" of virtually the entire series of contraptions for making expert gunners. He ranks in this category with Brig. Gen. Martinus Stenseth, in charge of the aerial gunnery wing of the Western Flying Training Command.

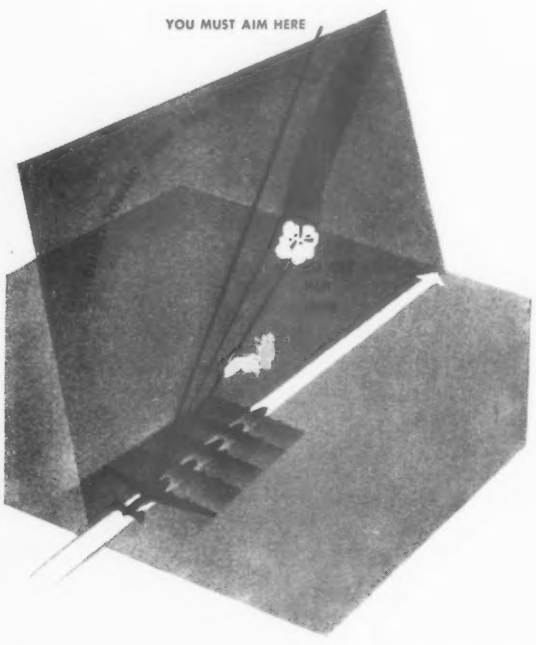
Colonel Huglin devised the triangular moving target ranges, the mobile skeet ranges, the idea of mounting shotguns on

to the bomber's line of flight and the fighter's speed and range. All this was reduced down to the following:

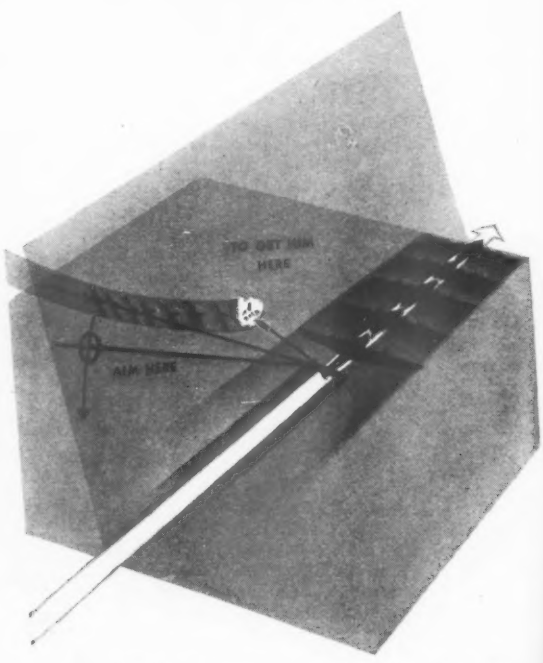
1. The only fighter which the defending gunner is interested in is the one bearing down directly on his plane. This is the fighter that is attacking, trying to score hits. This also is the enemy fighter which is easiest to hit despite the fact that it appears in the gunner's ring sight in, or nearly in, a headon position.

2. The attacking fighter must fly the curve of pursuit to hit the bomber.

3. The gunner does not always aim ahead or lead the target. Instead, he more often aims between the fighter and the tail of his own plane. This is because his bullet takes the forward speed of his own plane. Therefore, in addition to whizzing out at an angle toward the attacker, it also is carried forward at whatever speed the



In an attack from the front, the gunner deflects his aim toward bomber's tail to allow for bullet's forward speed.



Gunner deflects aim toward his own bomber's tail whether the enemy plane attacks from above, below, or at his side.

From there the tour went to Luke Army Air Forces Field, Phoenix, Ariz., where Col. John K. Nissley placed the writers aboard North American *Texan* trainers for a demonstration of ground strafing and firing at a moving target with fixed nose and wing guns.

It is here that the curve of pursuit is demonstrated to its fullest, and advance pilots get their first air-to-air gunnery practice. The perforated cloth of the targets show they are learning their lessons well. During the course they receive 30 hours of ground school training and 22 hours aerial practice, with .50-caliber machine guns and 37- and 20-mm. cannon.

One stop on the way was at Williams AAF Field, Chandler, Ariz., where a demonstration of the firepower of a *Lightning* was given. With three old airplane en-

turret gun mounts for shooting clay pigeons, and many other developments.

The RAF is credited with working out the beginnings of position firing. Starting with this system, mathematicians at Wayne University, Navy consultants in Detroit, Ordnance Department experts at Aberdeen, the National Research Defense Council, and operations analysts with the Ninth Air Force in North Africa, worked out the thousands of calculations on which position firing, or sighting, is based.

They calculated the amount of lead or deflection which a gunner has to allow to hit a fighter at any instant of attack. To do this, they had to make exact allowances for the bomber's speed, the muzzle velocity of its machine guns, the varying density of the air at different altitudes, the direction of the fighter with relation

bomber is traveling. This is the same principle as the kid on the bicycle delivering papers. If he aims the paper directly at the front porch, it probably will land in the bushes next door.

4. In making its approach, an enemy fighter, no matter from which point he attacks, must come in on the gunner's plane at one of a number of previously calculated angles. These angles form cones of fire. In position firing, the gunner is taught the proper sighting angles for each of these cones. His positions (between the attacker and the tail of his own plane) are figured in radii, or rads. A rad simply is the radius of his gun sight, or the distance between the pipper in the center and the outer ring.

If a fighter plane is coming in on the

(*Continued on page* 152)

COLORED SLEEVE TOW TARGETS ARE LOADED ABOARD NAVY MARAUDER (JM-1) TAKEN OVER FROM ARMY.

LATEST ARMY LIBERATOR IS B-24J, WITH 14 MACHINE GUNS.

FAIRCHILD FORWARDER (UC-61A) IS LIGHT AAF TRANSPORT.

OLD HALL PATROL BOMBER, STILL USED BY COAST GUARD. NOTE EXPOSED GUNNER.

Carrier operations at sunset were caught by a Navy photographer on the U. S. S. Wolverine on Lake Michigan. Texan above is taking off. Wildcat below spurts flame as pilot cuts throttle for landing.

THIS VERSION OF MITCHELL HAS 14 MACHINE GUNS AND 75 MM. CANNON.

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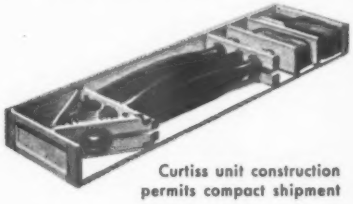
Grumman F4F Wildcat

Interchangeability keeps 'em flying

Unit construction and interchangeability helped put many a needed fighter back in the air again in the early touch-and-go days at Henderson Field. Emergency change of damaged blades, frequently found necessary in the midst of battle, is typical of the quick replacement possible through the Curtiss Electric's unit construction.

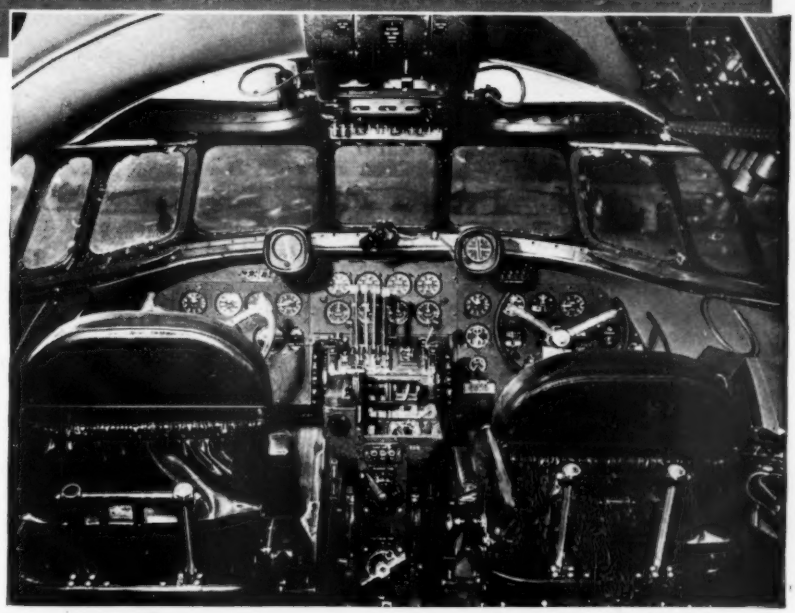
CURTISS ELECTRIC PROPELLERS

Curtiss-Wright Corporation, Propeller Division



Curtiss unit construction permits compact shipment

CONSTELLATION FLIGHT



In this cockpit, Howard Hughes and Jack Frye piloted Constellation to a new record.

By ERNEST BARCELLA

The Constellation's flight not only set a record but created a new standard for transcontinental air service in post-war years.

IT IS early Sunday evening, April 16. Howard Hughes and TWA President Jack Frye decide that tomorrow is the day. Edward J. Minser, TWA meteorologist, has predicted favorable weather. Orders go to make the plane ready.

It stands out on the field at Burbank, Calif., looking like a gigantic streamlined whale with wings, its back humping as though it is about to dive. The triple-ruddered tail helps identify it as the Lockheed *Constellation*, world's largest land-based transport plane.

Crew members and passengers are instructed to be aboard at three a.m. Pacific War Time, Monday, April 17. All hands are on deck an hour before take-off. Field lights cut through the darkness. The ground crew services the craft.

Hughes climbs into the cockpit, takes his place behind the pilot's controls on the left side. Frye moves into the co-pilot's seat on the right. C. L. Glover, radioman, slides into his spot behind Hughes. R. L. Proctor, flight engineer, takes his post behind Frye. Howard Bolton, navigator, goes into his compartment on the left side of the plane directly behind the cockpit.

At precisely 3:57 a.m. the *Constellation* starts rolling down the runway. Exactly 6 hrs. 57 min. 51 sec. later, at 1:54:51 p.m. Eastern War Time, the plane is over

Washington National Airport. A new transcontinental record has been set.

The estimated 2,300-mile trip was accomplished at an unofficial average speed of 331.6 m.p.h. The *Constellation* was operating at only 65 per cent of its maximum power. Frye said: "It was not a speed test. We came over in normal cruising power."

Further, flying conditions were not perfect. The flight started in darkness. A couple of detours were necessary to skirt restricted Army areas. Some "weather," including light icing conditions, made it necessary for the plane to veer slightly off the Great Circle route.

The *Constellation* cruises with nearly the speed of a *Lightning*, can outrun a Jap Zero. It is powered by the same 18-cylinder Wright *Cyclone*, 2,200-h.p. engines (See page 70) being used on the new Boeing *Superfortress*. Its flush riveting reduces drag; its triple rudders give it great stability. It is maneuverable and as simple to service as a DC-3.

Twelve passengers accompanied the five crew members on the memorable transcontinental trip. They were L. J. Chiappino, Leo Baron, Robert L. Loomis, Edward J. Minser, Richard De Campo (who relieved Proctor as flight engineer at the half-way point), Lee Spruill and Orville R. Olson, all of TWA; Richard Stanton, R. L. Thoren and Thomas Watkins of Lockheed; S. J. Solomon, chairman of the Airlines' Committee on Post-war Aviation Policy, and Lieut. Col. C. A. Shoop of the Army Air Forces.

Let us make the record-smashing trip with them. They have plenty of room in the big plane. There are quarters for four extra crew members. Behind these, on the right side, is a cargo compartment. A diagonal aisle separates it from the radio equipment room on the left side of the plane. Behind these two compartments is the passenger section.

The passengers have their choice of seats. On the left side is a row of 16 "bench" seats. On the right are 11 blocks of back-to-back seats, each block accommodating four passengers—a total of 44.

To the rear are galleys. The one on the left contains a coffee-heater, a food jug and a thermos; that on the right has a refrigerator and drinking water. Behind the two galleys are the two rest rooms.

Demonstrating big plane's capacity, this scene will be repeated in peacetime service when 57 passengers can ride comfortably in Constellation-type planes.

Today, however, the Constellations have gone to war. Stripped for military service, the planes can carry 100 soldiers with full-sized U. S. Army packs.

At 3:57 a.m., the *Constellation* starts rolling down the runway. In seconds, Hughes has it off the ground, climbing swiftly and smoothly. The field lights fade from sight. At 15,000 feet, Hughes levels her off.

The passengers chat casually. Bunks are made up for those few who feel the need of sleep.

Less than an hour after take-off the lights of Needles, Calif., wink below the left wing of the *Constellation*. (Fast trains usually require 11 hours to cover the same distance.)

Minutes later, Kingman, Ariz., comes into view. Only a few years ago transport planes had to stop here to re-fuel on the Los Angeles to Winslow, Ariz., run.

The sky is still clear. The weather at this point is CAVU—ceiling and visibility unlimited. But a "front" is expected ahead. Dawn breaks shortly after five a.m. as the *Constellation* roars toward Winslow.

Some of the dozing passengers stir. Olson and Watkins heat coffee. Breakfast is served in packed boxes—orange juice, fruit, cereal, sweet rolls, coffee and milk. Loomis goes up front to relieve Frye, who comes back for a bite to eat.

The sun breaks over the horizon. Minutes later Winslow is left behind. The *Constellation* swings north.

Just south of Durango, Colo., a bit of weather forms up. Clouds appear for the first time. Updrafts bounce the *Constellation* slightly. Light icing conditions develop near Wichita. Hughes takes the plane up to about 19,000 feet. Above, the sky is a deep blue. Below there is a solid mass of clouds. The ground won't be sighted again until near Cincinnati.

Outside, the temperature is below zero, but inside the passengers are in shirtsleeves.

The *Constellation* passes south of Kansas City and goes over Butler and St. Louis. East of St. Louis brisk tail winds push the plane along. She is crowding 400 m.p.h. and keeps it up to Cincinnati. The clouds below are breaking apart. Frye, who took over the controls somewhere over Kansas, brings the plane down a bit and levels off at 16,000 feet.

The descent is scheduled to start just east of Cincinnati but thunderstorms are reported over the Alleghenies. Instead, the descent starts at Elkins, W. Va. Soon, Frye has the plane down to 7,000 feet.

Somewhere near Cumberland, Md., there is the first evidence of excitement within the plane. Someone remarks that if Washington can be reached within 10 minutes, the *Constellation* will have a new transcontinental record. Up front, Frye and Hughes are not aware of this. But less than 10 minutes later, Frye circles Washington's National Airport and guns across the finish line. Newsmen below clock the finish at 1:54:51 p.m. (EWT), but when Hughes steps out and hears the news, he is astounded:

"I forgot to wind my watch," he admits sheepishly.

The *Constellation* is the new cross-

(*Continued on page* 146)

MULTI-MILLION MILER

By FRANK MUNI

Irwin Wladimar Smirnoff has passed the 3,400,000-mile mark in his drama-packed quarter century of piloting, and now is a member of the Dutch "incognito squadron."

AMONG the vari-striped and vari-starred pilots of the United Nations who fight the Japs above the islands of the Southwest Pacific, a chunky Dutch citizen of Russian origin, Iwan Wladimir Smirnoff, surely rates as one of the most remarkable.

Veteran air ace of World War I, recently a flying captain in the Netherlands Air Force in Australia, Smirnoff is regarded by his colleagues as the probable holder of the world's record for distance flown by one man. His log shows he has covered more than 3,400,000 miles by air.

This 48-year-old "air-mile millionaire" has spent most of his lifetime in the air, usually at the controls of giant commercial airliners. As a youth of 20 he fought with the Russian Air Force in World War I. The Soviet revolution made him a refugee and eventually he joined the British Royal Flying Corps. A few years later Smirnoff distinguished himself as the ace pilot of KLM (Royal Dutch Air Lines) on the 9,000-mile Holland-Java route. Smirnoff flew this route, one of the longest ever established for commercial airliners, regularly from the time KLM opened its Amsterdam-Batavia service in 1930, until Holland was overrun by the Nazi hordes in May, 1940, at which time he happened to be in the Netherlands Indies. His last flight from Java, on which he carried 12 passengers and $1,500,000 worth of diamonds, topped everything in his adventurous career. Indeed, this dramatic episode nearly ended his life and left a mystery which may never be solved.

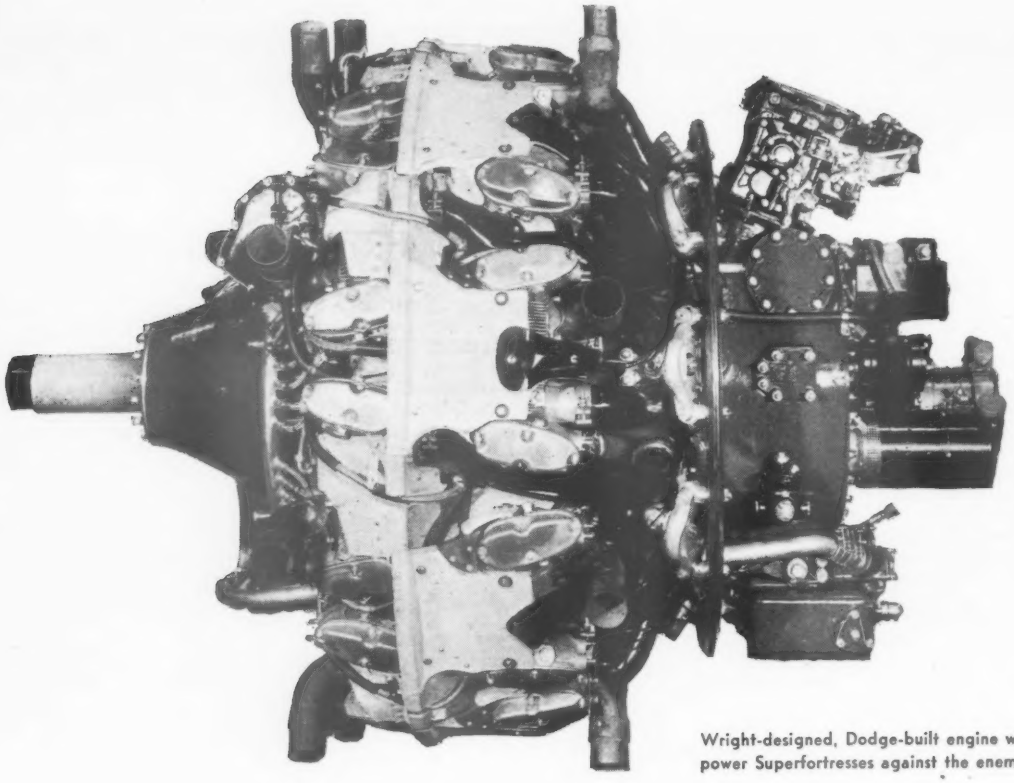
Smirnoff is one of many Dutch flyers who belong to the famous "Incognito Squadron"—officially known as the Netherlands Bomber Squadron—operating as part of the Allied air forces in the Southwest Pacific. These gallant flyers, mostly Dutchmen and Indonesians who escaped during the Japanese invasion of the East Indies, fight and die anonymously. If they are awarded decorations for bravery, their names are withheld from publication—for all of them have wives, children, parents or other relatives whom they want to safeguard from Japanese retaliation.

Captain Smirnoff learned to fly "by the seat of his pants". In the days of World War I there were no blind flying gadgets, no long technical courses. His career of adventure, beginning when he ran away from home at 19 to volunteer against the Germans, almost exceeds the imagination of the average red-blooded, air-minded American youth.

Iwan was born in Russia in 1895. His father, a farmer living near Wladimir, east of Moscow, wanted him to become a mining engineer.

But when Germany declared war on

(*Continued on page* 102)



Wright-designed, Dodge-built engine will power Superfortresses against the enemy.

SUPERFORT Power Plant

Huge Dodge Chicago plant is producing 2,200-h.p. engines in world's largest building.

By CURTIS FULLER

TWO years ago it was a grassy prairie. Today it is the largest aircraft engine factory in the world. It occupies 500 acres of ground; consists of 19 major buildings and a score of smaller structures. It is turning out unspecified but increasing numbers of huge Wright-designed 2,200-h.p. (plus) 18-cylinder two-row *Cyclone* engines to power America's new *Superfortress* (Boeing B-29) and other big aircraft. It is Chrysler Corporation's Dodge Chicago plant.

It is not a mere assembly line where finished or semi-finished parts are brought in from sub-contractors and finished, fitted and assembled as is the case with many other engine factories. It is a manufacturing plant in the truest sense. Raw steel bars and magnesium and aluminum pigs come in at one end and the completed engine emerges from a roar of test cells at the other. It is one of the few engine factories with its own complete forging shop, its own extensive magnesium and aluminum foundries.

The great sprawling industrial layout on Chicago's southwest side was designed for the sole purpose of producing the new Wright engine which has already seen service in powering the transcontinental record-breaking Lockheed *Constellation*.

Despite its high power output, the engine is only 55 inches in diameter, and has a magnesium nose section designed for fitting a small-diameter cowl. Its 18 cylinders have a displacement of 3,350 cubic inches. Propeller reduction gearing reduces revolutions to much less than half those of the crankshaft. A two-speed gear-driven supercharger maintains power at high levels but turbosuperchargers can be fitted for extra high-level operations. The weight-power ratio is a little over one pound per horsepower.

Production statistics on the new engine are restricted as they might reveal the volume of big plane production. K. T. Keller, president of Chrysler, has revealed, however, that "the weekly output of engines from this plant will have a rated horsepower capacity equal to the entire generating capacity of Boulder Dam." Another hint is that, in full production, the operation of engines in test cells alone will consume 88,000 gallons of gasoline each day.

Since so little can be told about actual engine output, officials have had to compile virtually every other statistic in the book to indicate the huge scope of their enterprise.

The machining and assembly building, the largest structure in the layout, for

Gigantic hammers, hitting with maximum force of 56,000 tons, forge rough shapes which precision machinery will bring to unbelievable accuracy in later operations.

example, is also the largest building in the world and has more floor space than either Washington's famed Pentagon or Chicago's Merchandise Mart. It houses more than 7,000 machines—lathes, shapers, drill presses, millers, grinders—all the intricate equipment necessary to process the roughly-shaped raw metal parts into polished precision fittings of extreme accuracy.

Under its ribbed concrete arch roof (which saves 40 per cent of the reinforcing steel used in conventional designs) are nearly 1,000 standard-size production bays 30 x 38 feet—each covering an area larger than the average small house.

Traffic flow within the plant is unique. Two lengthwise tunnels and one crosswise tunnel extend under this main structure with stairways leading to locker rooms, lavatories, nine cafeterias (there are 14 in the entire plant) and kitchen. A worker driving into the main parking lot, a block wide and a mile long and capable of accommodating 8,000 cars, walks down some steps, shows his badge to the guards, and enters the building through one of the main tunnels. He walks underground to his assigned locker room and finally emerges at the stairway nearest his work bay or station. This eliminates jams at shift changes and the two flowing streams of workers and parts meet only where they are intended to. There are 10 acres of tunnels, washrooms, cafeterias, kitchens and other services underground.

The plant is built on a rectangular plot facing west toward Chicago's Cicero Avenue. Flanked by tool house and plant protection buildings, the administration building is an exaggerated H connecting with the machining and assembly building directly to the east. Back of the latter and to one side are one of the two power houses and the oil and chip recovery building. Behind these are the twin magnesium and aluminum foundries. Farther east are the die shop and heat-treat buildings, the heavy and light forge buildings and the second power house.

Production moves in the opposite direction—from forge buildings, die shop and heat-treat building and foundries to the machining and assembly building.

Forty-one steam hammers eventually will be installed in the forge shops which are already operating at a high enough rate to be producing for other engine factories. They contain hammers as heavy as 35,000 pounds hitting with a force of 56,000 tons on a basis of their full 50-inch stroke and 80 pounds of steam. The forge shops make typical rough forgings such as crankcases, master rods, articulating rods, gear forms. Only the cylinder barrels have been produced elsewhere and now even these are to be forged on huge eight-inch upsetters undergoing installation.

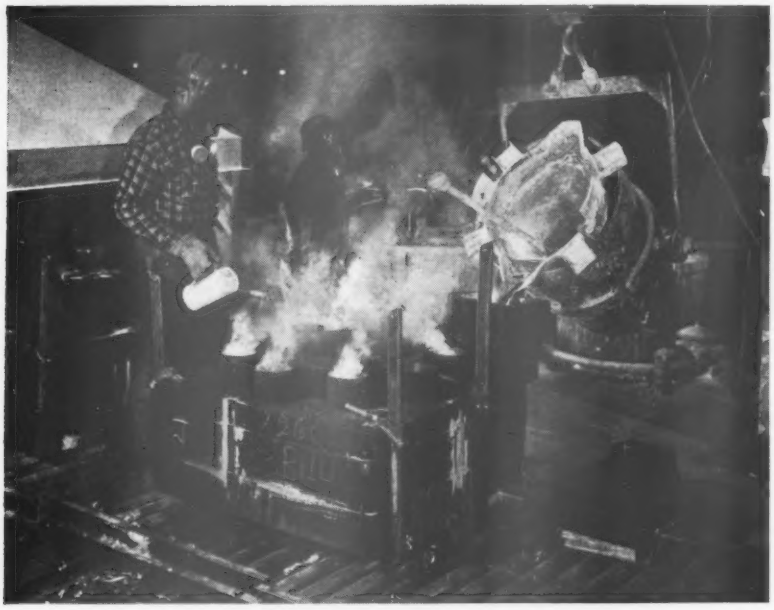
With spatter of glowing sparks, the big hammers shape steel billets like biscuit dough. They rest on foundations 30 feet deep, consisting of 10 feet of concrete on the bottom, layers of huge oak timbers laid crosswise to form a "cushion," and steel caps totalling more than 300 tons in weight. The whole foundation for these hammers floats free, has no structural connection with the building which the vibrations would otherwise shake down. Guards in distant watchtowers say their towers shake and dance when the hammers strike.

From the forge shops, the slowly-cooled forgings are taken to the heat-treat plant where the three stages of heat, cooling and oil bath are accomplished mostly automatically.

While the forge shops, heat-treat plant and die shop are fabricating rough steel shapes for the engine, the aluminum and magnesium foundries are preparing other rough forms by quite dissimilar methods. In operation little more than a year, these two foundries are already pouring huge quantities of magnesium and aluminum each month. At capacity, more aluminum and magnesium will be poured than in any other foundry in the world.

Typical of aluminum foundry operations is the casting of intricately-finned cylinder heads in sand molds—a process contrasting markedly with the production of aluminum heads for this same engine by the forging methods of Wright Aero-

Sand is packed around die in molding machine and vibrated. Then the die, at upper center, is lifted out, leaving the imprint of its half cylinder-head shape in sand.



Pouring magnesium supercharger housing section. Smoke is escaping sulphur gas.

nautical Corporation.

Each precise die takes the form of half a cylinder head. The molding sand is packed into the molding machine, compressed and vibrated. Then the die is carefully removed, leaving its form imprinted upon the sand. A binding liquid is sprayed gently on the sand mold and the whole is placed on a slowly-moving conveyor which winds through a baking furnace. The hardened mold is then inspected, burned with a blow torch to keep metal from adhering to the sand, cores added, the companion half fitted and the assembly clamped together.

Then, continuing on its slowly-moving line, the mold is poured, the aluminum cools, the clamps are taken off and the mold is opened with a bar. Typically efficient is the operation of reclaiming nearly all the molding sand—a considerable item given an annual consumption of 4,800 carloads of sand each year. Now only about 100 new carloads per year have to be added to the reclaimed sand.

The finned casting is cleaned when taken from the mold and given a rough machining, then inspected, put into stock and finally finished in the machining and assembly building. Chrysler engineers have so improved the technique of casting aluminum cylinder heads that only about 100 steel pins, instead of the 1,400 formerly required, are placed in the mold to keep the sand from breaking during pouring.

Typical magnesium castings are the supercharger housing and the engine nose piece. Workmen must be extremely careful in handling this inflammable metal. Pouring pots are connected with pyrometer blocks wired to temperature gauges in a separate room. Alert women watch the gauges constantly and direct the pouring operations by a series of signals telling the foundrymen when to fill the mold with sulphur gas, when to sprinkle sulphur on the molten magnesium, and when to pour. Magnesium is tricky and dangerous. It must be poured at exactly the right temperature. Sulphur gas must keep oxygen away or it might flare up.

In the machining and assembly building, the engineers carry out the general automotive policy of simplifying and breaking down production operations as far as feasible. In contrast with the long experienced aircraft and aircraft engine builders who developed their production methods out of small scale operations using relatively skilled workers, the automobile manufacturers have traditionally depended on machinery to do as much of the work as possible.

This entails a heavier investment in machinery but permits utilization of less skilled workers—a beneficial fact in today's manpower shortages. Most machining and assembly workers supervise one machine or possibly several machines which turn out finished products almost automatically with fixed settings made by comparatively few highly skilled workers.

The many thousands of workers at the Dodge Chicago Plant are being increased as rapidly as new workers can be trained, but even with simplified operations this is a slow process. Spokesmen say that their training program would make a modern university look like a small town. Today the initial complexities are unravelled; new workers are constantly being added, new machinery lines are going into operation, an ever-increasing number of engines is coming off the end of the line.

Within the main building is a vast panorama of activity, fading away in the distance as far as the eye can see beneath the low roof. Moving down the assembly flow, the raw parts are machined and finished. Rough castings become gleaming stacks of polished metal pieces. Slowly they are assembled into meaningful forms and sub-assemblies, which converge toward the final assembly line, in a 22-acre air-conditioned section whose temperature and humidity are carefully controlled by 80 air conditioning units.

At the end of the line, the engines roll off on specially-designed mounts. They are run in test-cells for several hours with their power hitched to big generators on a power-recovery system which supplies electricity throughout the plant. Eventually much of the factory's electricity will be produced by engines under test.

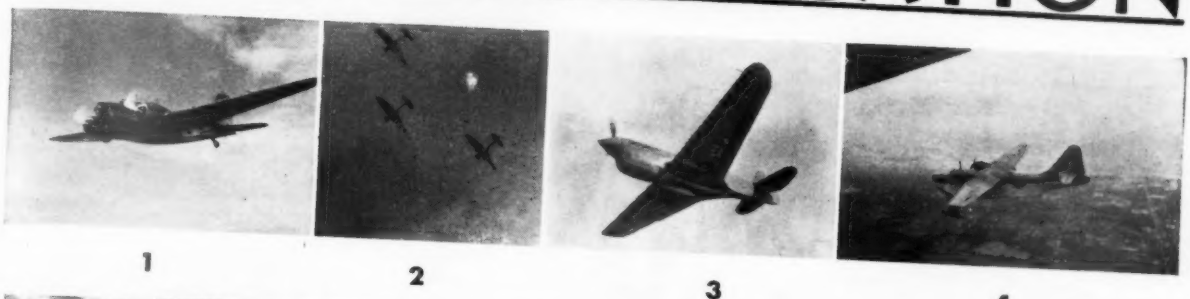
After their first run, the engines are completely torn down, inspected, tested again. Only then are they ready for the armed forces.

Though virtually the entire engine has

(*Continued on page* 170)

Cleaning supercharger housing casting. One man can easily lift this big piece.

FOR IDENTIFICATION



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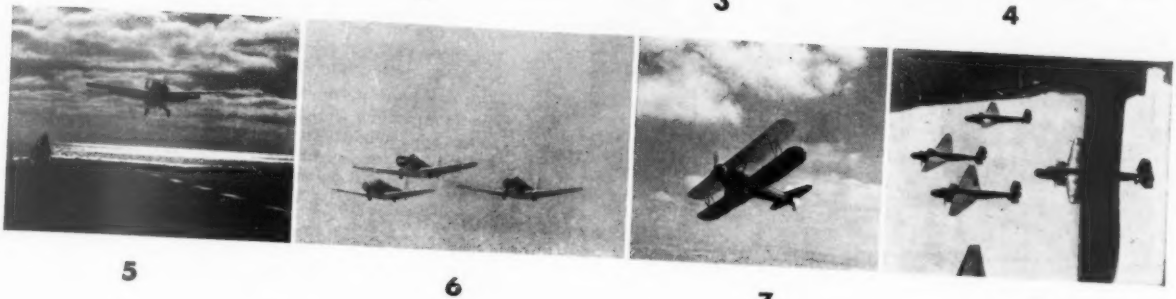


5 6 7 8

The planes are: 1. Douglas Boloi; 2. Claude (Mitsubishi) S-96); 3. Curtiss Warhawk; 4. Boeing Sea Ranger; 5. Grumman Wildcat; 6. Douglas Devastator; 7. Boeing Cavdet- 8. Nell (Mitsubishi) OB-96)

Douglas Skymaster

Focke-Wulf Kurier

Copyright, FLYING, July, 1944

Skymaster length: 93 ft. 10 in.

Kurier length: 78 ft. 3 in.

MISTAKEN IDENTITIES

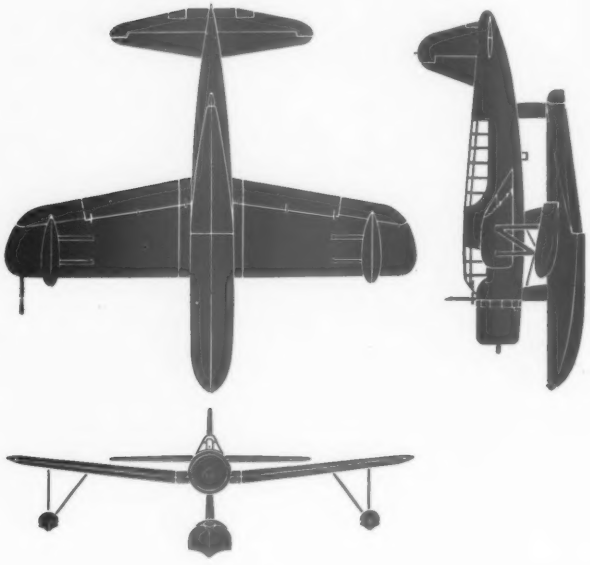
RECENTLY there have been several tragic accidents in aircraft recognition. Two received world-wide publicity: the shooting down of 23 U. S. transports by American gunners, and the destruction of an unarmed Douglas *Skymaster* by British carrier-based fighter pilots over the North Atlantic. The latter was a glaring error in mistaking the *Skymaster* for a German Focke-Wulf *Kurier*. Both are shown here to exact scale. All pilots should study these and other mistaken identities with great care.

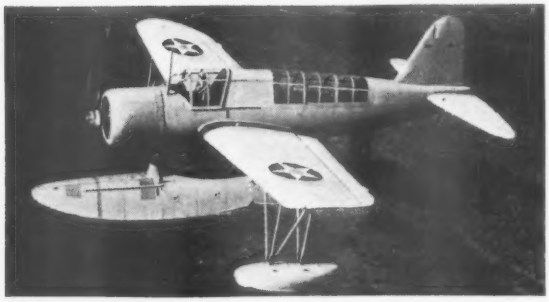
Skymaster span: 117 ft. 6 in.

Kurier span: 108 ft. 6 in.

VOUGHT KINGFISHER

Observation Scout





PERTINENT FACTS: Though obsolescent, the veteran OS2U still is the best type of its class in the U.S. Navy. Production ended in 1943, yet the *Kingfisher* still serves the Fleet in its original role of an observation scout. A two-place low-mid-wing monoplane, it is powered with a 450-h.p. *Wasp Junior* engine. The seaplane version (for catapult work) is 33 ft. 10 in. in length. Span is 35 ft. 11 in., height, 11 feet. Top speed is approximately 171 m.p.h., range about 1,000 miles. It carries two .30-caliber guns, plus bombs.

WHAT TO LOOK FOR: The cantilever wing has pronounced dihedral, straight leading edge and tapered trailing edge. The blunt tips are rounded. The wingtip floats are prominent. The monocoque fuselage carries the large single main float. The cantilever tail unit is conventional.

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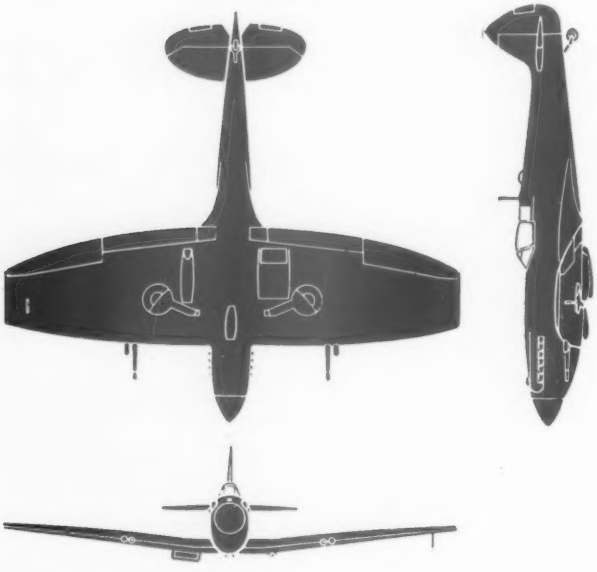
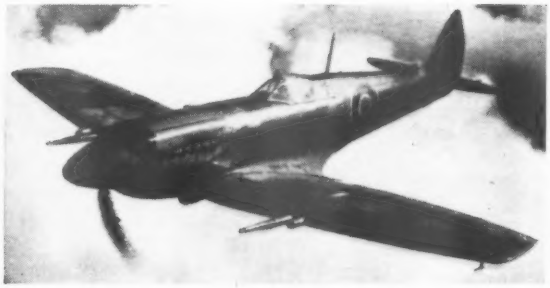
SUPERMARINE SPITFIRE XII

Fighter





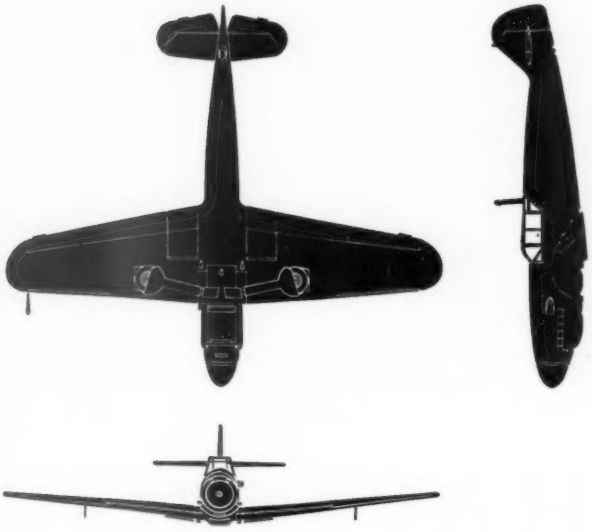
PERTINENT FACTS: Latest *Spitfire* to go into combat, the *Spitfire XII* is powered with the new 1,500-h.p. Rolls Royce *Griffon* liquid-cooled engine. At first glance, particularly from underneath, the plane looks like the older clipped-wing *Spitfire V*. The *Spit XII* fuselage was redesigned and strengthened to take the new engine. Performance data still are restricted, although it has been announced that the engine has a two-speed mechanical supercharger. The *Spit XII* has high rate of climb at low altitudes, as well as maneuverability. Armament can include four 20-mm. cannon.

WHAT TO LOOK FOR: A cantilever, low-wing monoplane with moderate dihedral and square tips, the *Spit, XII* is easily mistaken for the *Spit V* in all but the side view. Note that the nose has been redesigned, as has the somewhat larger rudder.

British Air Ministry silhouette.

MESSERSCHMITT Me-109F

Fighter



PERTINENT FACTS: Still used in considerable numbers by the Luftwaffe, the Me-109F is another modification of the old Me-109 fighter with which the Germans started the war. The "F" is powered with a 1,300-h.p. liquid-cooled engine which gives it a top speed of 365 m.p.h. at 22,000 feet. Cruising speed is 310 m.p.h., range is 570 miles and service ceiling 37,000 feet. Armament includes a 20-mm. cannon firing through the propeller hub and two 7.7-mm. machine guns above the engines. A 500-pound bomb can be carried externally. The Me-109F in the photograph above was being tested at Wright Field after its capture in Africa.

WHAT TO LOOK FOR: A low-wing, cantilever monoplane, the Me-109F wing has moderate leading and trailing edge taper and rounded tips. The fuselage is narrow and squat. The tail unit looks undersized and differs from the Me-109E in that it is entirely cantilever. The head-on appearance might be mistaken for a *Spitfire*.

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KATE

Torpedo Bomber

PERTINENT FACTS: Little specific, accurate information is available on this torpedo bomber, officially named Kate, but technically the Nakajima G-97. Patterned a good deal after the old Vought *Vindicator* scout bomber of the U. S. Navy, the Kate still is widely used by the Japs. It is reported to be powered with a 700-h.p. air-cooled Hikari engine and to carry a crew of two. Wing span is 51 ft. 2 in., length, 34 ft. 6 in. Armament is two fixed machine guns and one flexible rear gun. A single torpedo is carried externally (see photograph).

WHAT TO LOOK FOR: The low, cantilever wing has marked dihedral from the center section outward. The wing also tapers on the leading and trailing edges and has rounded tips. The circular fuselage is marked by the high, long cockpit canopy. The tail unit is cantilever and triangular in shape. The landing gear is retractable, but the tail wheel is fixed.

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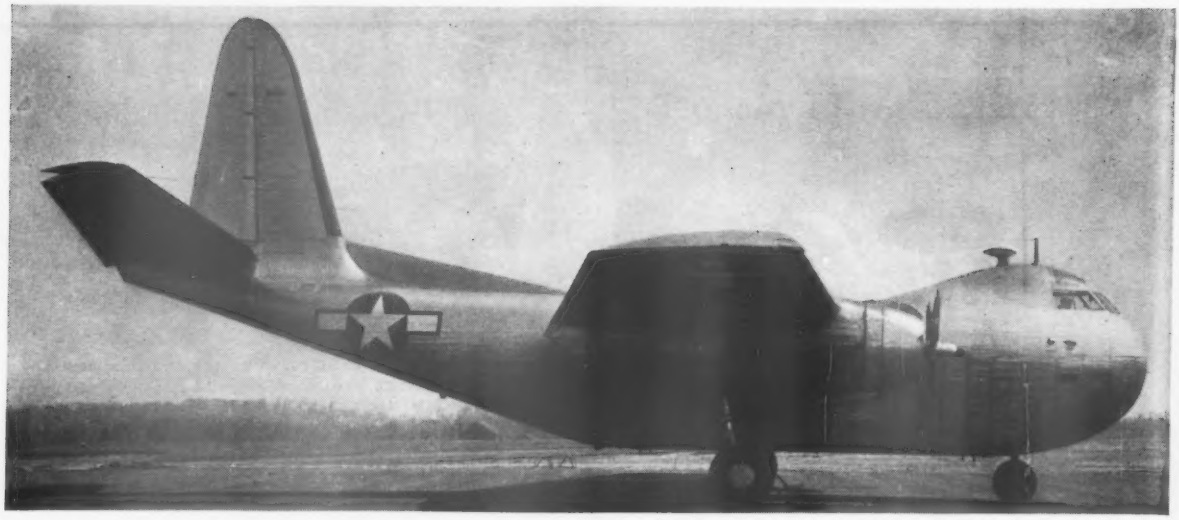
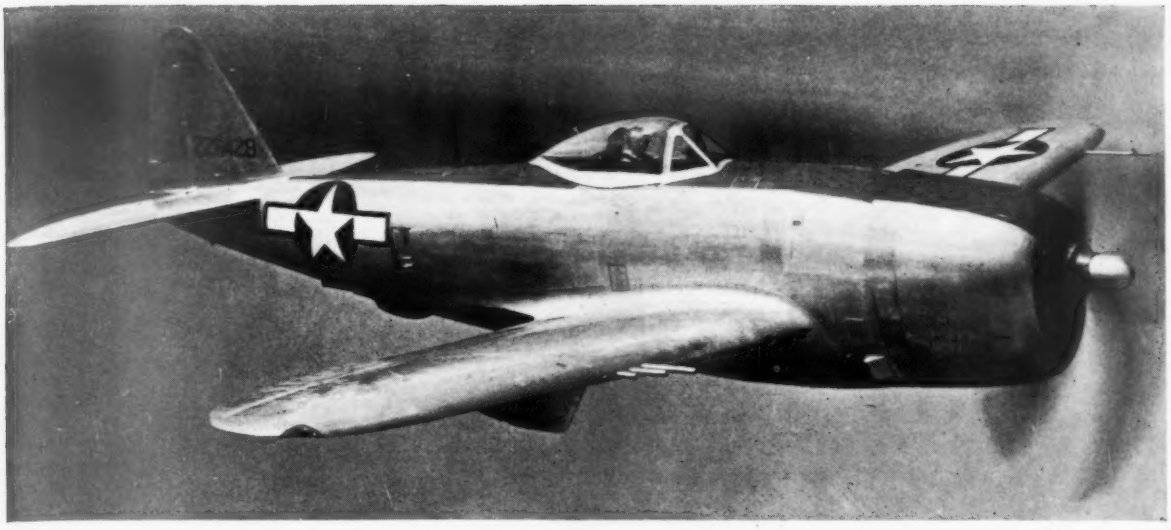


Budd Conestoga (RB-1) is the first specially-designed cargo plane for the Navy. Built of stainless steel, the Conestoga has two 1,200-h.p. engines, cruising speed of 165 m.p.h., normal range of 600 miles. Span is 100 feet, length, 68 feet. Normal cargo load is 10,400 pounds.

HAVE YOU

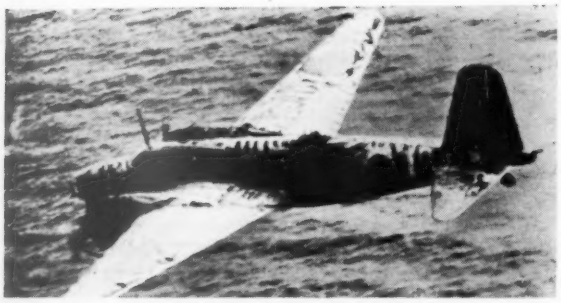
Unlike more common egg-shaped belly tanks, this new tank is flatter, holds 175 gallons, is used in fighter ferrying.

First picture of U. S. Navy skip-bombing with incendiaries in Pacific area was taken by FLYING photographer W. Eugene Smith at Eniwetok on February 1. In picture at left, clusters of four-pound incendiaries are being loaded in Avenger bomb bay. Picture at right shows Jap warehouse burning a few seconds after Smith's pilot virtually tossed the incendiaries in the door. Pilot then circled fire to take photographs.



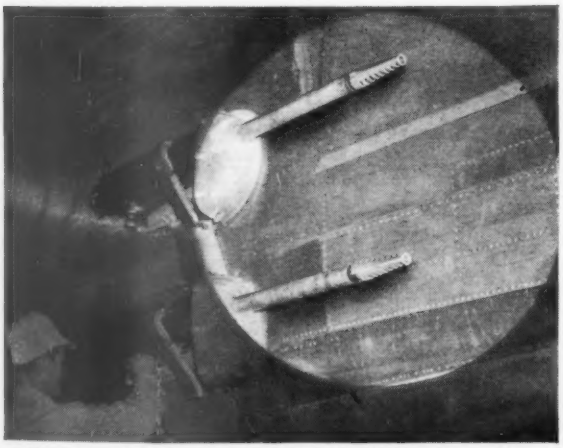
Latest version of the Republic Thunderbolt has a new "bubble" cock-pit canopy. This is the latest fighter to be so equipped. The North American Mustang recently was announced with this type canopy. Other fighters using it are the British Hawker Typhoon and the German Fw-190.

SEEN?



This Jap Sally II was shot down a few seconds after this picture was taken from a U. S. bomber. Sally II has two 1,000 h.p. engines, top speed of 264 m.p.h. Note unusual camouflage and tail "stinger."

Based on the famed Wellington bomber design, the Vickers Warwick transport has just been announced. Two American Double Wasp engines are used. Span is 96 ft. 8½ in., gross weight, 45,000 pounds.



Brass blast deflectors now are being installed on the muzzles of package guns on the latest Mitchell bombers. They keep the blast of the guns from injuring skin on the plane's fuselage.

Now undergoing Air Forces field tests, the Kellett YO-60 autogiro probably will be used for reconnaissance. It is two-place and powered with a 300 h.p. Jacobs engine. Rotor is three-bladed.

I Learned About Flying From That!—No. 58

The author in cockpit of Douglas Dauntless in South Pacific area, 1943.

By Lieut. WALTER M. SESSUMS

Lieutenant, USNR, Commanding VS-58

With no evidence, the author decided that vapor lock had caused his engine to quit. He took off again and crashed.

WHEN you're flying an airplane and the engine suddenly quits there is always a definite reason why it let you down. The hardest way to learn is by experience but unfortunately you don't always get that second chance. I was lucky, but the experience described here made me realize that a flyer cannot take anything for granted. I made up my mind then to check, re-check and double check.

It was a broiling summer day when I walked out to the line of trainers warming up for the noon flight. My instruction flight was scheduled for the spin area and, after I singled out my plane, I went through the routine inspection of tires, flying wires, fabric and control surfaces, then climbed aboard.

My student was already settled in the after cockpit and gave me an "up" as I climbed on the wing, signifying that he had checked his engine and was all set to go. As I strapped on my gosport speaking tube I went over the instruments, fuel gauge and fuel selector valve, then signed the ever present yellow sheet showing that I accepted the plane for flight. We fell into our place in the long queue of trainers, turned into the wind on the runway, checked the engine once more for full power, and started our take-off.

Then it happened. The wheels had just left the ground when the engine quit completely without warning. I concentrated on the landing and somehow succeeded in braking to a stop before running into the drainage ditch at the end of the runway. At Pensacola during cadet days all instructors had drummed unmercifully into my brain the safety rule of never diverting attention from flying the airplane at low altitudes. Never duck into the cockpit to see what the trouble is when you're near the ground, they had all lectured. Those lectures paid off now. We were towed off the field behind the crash truck rather than in it.

While we were being towed in, I could come to no definite conclusion as to why the engine had stopped. I knew that numerous take-off accidents had been attributed to fouled engines caused by prolonged taxiing or idling at low r.p.m., but before taking off I had held the brakes and checked for full power. It's just as important to do this on a large field as on a small one. The fuel valve had been turned on and the tanks had just been topped off. No cause for stopping there, I thought. It must be internal mechanical trouble.

The plane captain inspected the engine and could find nothing wrong. The engine started again without difficulty. A check of both magnetos indicated no power loss, nor was there any loss at full throttle. It was finally concluded that although vapor lock need did not always cause engine failure, this was one of those aggravated cases where the extreme atmospheric temperature of that particular day was responsible. This assumption, without concrete proof, was my first mistake.

To prove my contention, I took the plane out for a short test flight, being careful to stay close to the field in case of another failure, but as the engine ran smoothly I broke away from traffic and started a climb up to about 5,000 feet in the spin practice area. Perhaps if we had performed any unusual maneuvers on the way the impending trouble would have shown up and we could have gotten down safely in any of a number of suitable clearings. As it was, we just climbed along, making gentle S-turns until we leveled off at 5,000. The engine purred along without strain, even as we made several steep vertical turns in each direction.

After demonstrating several stalls, I gradually closed the throttle and pulled the nose up preparatory to entering a spin. The plane fell off and I held it for about two turns before stopping the rotation and bringing the nose up. After leveling off I applied throttle gradually and used our excess speed in a climb to gain altitude once again. Then, after we had climbed for about a minute, the engine again stopped without warning.

I nosed over immediately into a normal glide and quickly checked the instruments, noting that the fuel pressure was zero. There was more than sufficient gas in the tank and the selector valve was still in the "ON" position, meaning a decidedly clogged fuel line. There was no wobble pump in this type of trainer, the tank being in the upper wing center section, so I kicked the plane around trying to loosen any foreign matter in the line. Nothing happened. As the propeller turned over in the wind, making that utterly useless whistling sound, I turned attention to finding a landing spot.

We still had 3,000 thousand feet of altitude but it was not much help for the spin area was over a large swamp with nothing but cypress trees, water and mud covering the surface. I spotted a small clearing cut out from the trees, looking as if some trapper had tried cultivation only to give up in disgust. It was just about parallel with the surface wind and I elected to chance a landing on it rather than bail out over the swamp.

We unbuckled our parachutes and threw our goggles back out of the way, tightened our safety belts in case we went over on our back—which turned out to be a wise precaution. I spiraled down

(*Continued on page* 172)

After Victory you can land your Piper Cub at Fairville and countless other towns which are building landing facilities today. These communities are looking ahead to the coming air age—providing flying facilities for their sons and daughters upon their return from the Service.

Fairville's landing area is modest—just a simple, straight sod strip. But there's ample room for expansion as traffic warrants.

Is your town ready to fly? For its citizens' convenience, increased business and many other benefits, your town should plan landing facilities now! A new booklet, "What Your Town Needs for the Coming Air Age", gives the why, where and how of building landing facilities. For your free copy, write Piper Aircraft Corporation, Department PA74W, Lock Haven, Pennsylvania.

GET YOUR AVIATION BOOKLET—"Piper Cub . . . In War and In Peace". Full color, 32 pages. Covers history of light plane. Piper Cub planes, coming air age, how to fly. Enclose 10c in stamps or coin for postage-handling. Write Piper Aircraft Corporation, Department PA74, Lock Haven, Pennsylvania.

16mm. SOUND FILM—"The Construction of a Light Airplane". For distribution points write: Supervisor, Audio-Visual Aids, Extension Services, Pennsylvania State College, State College, Pennsylvania.

PIPER Cub

Points the Way to Wings for All Americans

Letters

MESSERSCHMITT OR MERSEBURG

Sirs:

It is my belief that the aircraft you identify on page 73 of the May issue of FLYING entitled "Messerschmitt Me-323" is not a Messerschmitt, but a Mercerberg.

DON HUBBARD
Pilot, Western Region
Northwest Airlines, Inc
St. Paul, Minn.

Sirs:

I have a thorough knowledge of airplanes but something has been puzzling me for quite a while. You have a plane in the "For Identification" section of your May FLYING with the caption of Messerschmitt Me-323. I have seen it called the Meresberg 323 in a number of magazines. Please inform me which one is correct.

GERRY STRAUS
Baltimore, Md.

● Merseburg (not Mercerberg or Meresberg) is a big Luftwaffe station west of Leipzig. We don't know just how Merseburg came to be associated with the Me-323—possibly there is a factory there where these planes are built. Long before the official German type designation, Me-323 "Gigant," was made public, the largest freight carrier of the Luftwaffe was known as the "Merseburg Giant." Apparently a few outsize aircraft were observed by the reconnaissance crews on the Merseburg airfield and were called "Merseburg Giant" for want of a better name. The Germans themselves, however, have revealed its real designation, the Messerschmitt Me-323 "Gigant."—ED.

REVERSED PROP

Sirs:

In the "Have You Seen?" section of the May FLYING there is a picture that might cause some confusion in the minds of the readers. The Republic *Thunderbolt* is shown equipped with two different types of propellers. The Hamilton Standard seems quite normal, but the Curtiss prop appears to have reverse pitch. What's the deal, are they using props for brakes now?

By the way, your magazine is tops, keep up the good work.

J. S. HARMON
Dallas, Tex.

● Our fault. The picture with the Curtiss prop was reversed.—ED.

McDONNELL GUNNERS

Sirs:

In the May issue of FLYING is a story of the Fairchild-designated AT-21. In the description entitled "Pertinent Facts," it is stated that this plane is manufactured by Fairchild and Bellanca. I wish to . . . inform you that the McDonnell Aircraft Corporation is producing this plane in our Memphis plant under a prime contract from the United States Government. This contract is exactly the same as that of Fairchild and Bellanca.

ROY W JORDAN
Staff Assistant to the President
McDonnell Aircraft Corporation
St. Louis, Mo.

REILLY AGAIN

Sirs:

In answer to Myron Scott's letter in the May issue of FLYING, I say why don't all these people who are arguing over General Reilly's article arm themselves with rifles?

General Reilly is hurting no one by voicing his opinion. The Army Air Forces doesn't take it seriously. Why should the readers of your magazine? If they didn't like the article, why did they read it?

DONALD J. SCHRANDT
Upper Darby, Pa.

Sirs:

The article on "Misuse of Air Power" by Brig. Gen. H. J. Reilly is one of the best articles I ever read. . . . I hope other issues of FLYING will find their way over here.

PVT. L. J. KAZMICRCZAK
Somewhere in the E.T.O.

MORE THAN A SMIRK

Sirs:

Of course, anyone is likely to say something a little "off the beam" once in a while but I couldn't let the remarks about the Society of Automotive Engineers go unchallenged from your May issue. Being a member of the S.A.E. myself, I suppose that my remarks are not without prejudice, but I feel that the producers of the Aircraft Materials Specifications are due a little more than a smirk by the Washington editorial staff of FLYING, along with the Aeronautical Chamber of Commerce.

Though I am in doubt about the actual function of the ACCA, having heard only of them in connection with the usual "welcoming and lauding" ceremonies, I feel that the S.A.E. would not have been asked to produce a set of standardized aeronautical specifications by the Government if the ACCA had been capable of the same.

Our licensors are a grand bunch assisting us in every way and, I think, truly glad of our mutual co-operation, but I'm sure that their interests are hardly being advanced by an organization with an attitude such as that portrayed by your "Washington correspondent" as being that of the Aeronautical Chamber of Commerce. . . .

JOHN R. HERRON
Buick Motor Division
Melrose Park, Ill.

● No reflection was intended on the work the SAE is doing in aviation. Some of the industries' best and most instructive meetings are those sponsored by the Society. Both the SAE and the Aeronautical Chamber of Commerce are doing excellent and outstanding work in standardizations. Their efforts do not overlap but are constructively parallel. Actually, the SAE has done an outstanding job on Aeronautical Material Specifications, as has the ACC's National Aircraft Standards Committee on aircraft parts. Both efforts have been invaluable to the war effort.—ED.

MR. COT SPEAKS

Sirs:

In your March issue, FLYING published an article on French aviation, "The French Air Force Never Fought," the title of which could be interpreted very unfavorably.

In order to clarify the intentions of the author, it would be greatly appreciated if you would publish the statement enclosed herewith which was transmitted from Mr. Pierre Cot.

BRIG. GEN. CHARLES LUGUET
Chief of the French Air Force
in the United States
Washington, D. C.

MR. COT'S STATEMENT

"I never wrote a line or said a word from which inference can be drawn that French flyers did not fight with courage in 1939-1940.

"Quite to the contrary, in my writing and in my speeches, I have paid tribute to their heroism. I have particularly pointed out that each time they had an opportunity to meet the German aviators they inflicted greater losses than they sustained.

"On the other hand, I have maintained that due to lack of equipment, and to organization unsuitable for modern warfare, they were often obliged to fight under most adverse circumstances. . . ."

Signed: PIERRE COT

WHY, MAJOR!

Sirs:

We, a few members of the 312th Fighter Sqdn. have read with avid interest and bated breath, Maj. John C. Meyer's account, "I Learned About Flying from That," in your April issue. This rat-racing dive into the pilot's trap of vertigo completely astounds us.

With all due respect to the major's rank, we wish to point out a few glaring discrepancies in his article.

Discrepancy No. 1. "I was an experienced instrument pilot." The major must have been a very good instrument pilot if he could center the needle and ball in an inverted position. Anyone can look at the turn and bank indicator and see that in an inverted position the ball will rest either on the extreme left or extreme right. It cannot be centered in inverted flight.

Discrepancy No. 2. "There was nothing I could do but continue back pressure on the stick. . . ." When we were instructing students, we always taught them to do a half-roll and recover straight and level instead of doing a split-S and winding up in a death-defying dive.

(*Continued on page* 158)

1894-1944

Pioneers for 50 Years

For half a century, The Cleveland Pneumatic Tool Company has devoted itself to serving many major industries.* Skilled technicians and experienced engineers within our organization have pioneered and perfected many products for each of these fields. Thus initiative and resourcefulness have enabled us to keep abreast of this country's remarkable industrial progress . . . We are commemorating our golden anniversary by continuing to put all our talents and energies in the fight to preserve the American way of life. We are proud to have grown with our nation for 50 years, and look forward to serving in the great future that lies ahead.

Buy U. S. War Bonds and Stamps

**CLECO Pneumatic Tools speed production in metal-working plants. AEROLS (the shock absorbing landing gear used so universally on aircraft) insure safe, smooth landings and take-offs. CLEVELAND Rock Drills are widely used in the mining and contracting fields. CLE-AIR Shock Absorbers protect buses, trucks and trailers from road shocks.*

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AND SUBSIDIARIES
THE CLEVELAND ROCK DRILL DIVISION CLEVELAND PNEUMATIC AEROL, INC.
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The bomber pilot of this war is schooled in twin-engine trainers so far ahead of anything you flew that it isn't funny!

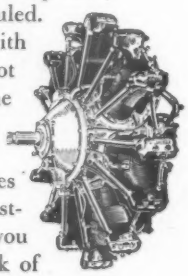
During this transitional stage, the student pilot of today has *three* parachutes . . . He sits on one, and the other *two* are in the nacelles—a pair of Jacobs engines.

Remember how the old OX occasionally changed its tune in the air, and gave off a faltering falsetto that made your heart crowd your tonsils, waiting for engine failure? Well, this Jacobs engine sings bass all the time! There isn't anything your kid can do, short of crashing, that hasn't been done to a Jacobs before, in the fifteen pre-war years it was being developed.

THE JACOBS has no more temperament or tricks in its system than a sewing machine. As long as the gas keeps coming, the engine keeps going, and never plays tag with the tachometer or the pilot's nerve centers.

Under student handling, the Jacobs stands up for more than a thousand hours between scheduled major overhauls. Enough air hours to send fifteen students on to the next stage!

AND the Jacobs doesn't need a genius to service it, either. It is simple in construction, durable in all its parts, sparing of shop time, easily checked and quickly overhauled.



So while your son is training with the Jacobs, engine failure need not bother you or him . . . And this engine is kind to the taxpayers, too, in fuel consumption and upkeep costs.

The war record of these engines makes Jacobs worth watching for post-war planes and operation . . . If you ever find yourself a passenger back of one, you'll know that the operator knows his engines, and isn't careless with costs . . . Jacobs Aircraft Engine Co., Pottstown, Pennsylvania.

JACOBS · **Pottstown, Pa.**

Look out for one-way streets!

Exclusive Crown Zipper tooth design makes the Crown zipper track a two-way "street"—sliders work quickly, smoothly, almost effortlessly, in both directions!

Things began to happen fast when Crown Zipper engineers went out into the field with our armed forces to adapt zippers to special military jobs.

Out of Crown's experience have come five big basic advancements over old-style, conventional zippers (see list below)—and one of the most important of these is the superior construction of Crown Zipper teeth.

If you examine a Crown Zipper closely, you see that both sides of each tooth are identical. This permits sliders to operate smoothly, quickly, almost effortlessly, in either direction along the zipper track.

In addition, this exclusive Crown Zipper tooth design permits two or more sliders on the *same* track—making Crown the only zipper in the world that provides quick, convenient openings at any given point, with smooth closures in *both* directions. (One recent Crown application actually has ten sliders!)

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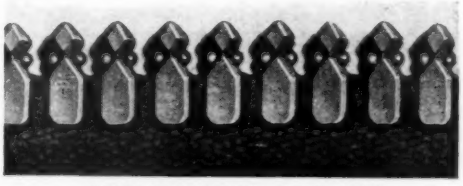
When *you* turn to postwar, Crown engineers, fresh from their experience in designing hundreds of military items, will adapt—or, if necessary, *create*—special zipper applications to meet special problems.



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1. Takes sharp curves

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THE LIBRARY

METEOROLOGY THEORETICAL AND APPLIED, by E. Wendell Hewson and Richmond W. Longley; Published by John Wiley & Sons, Inc. 468 pp. Price $4.75.

METEOROLOGY WORKBOOK WITH PROBLEMS, by Peter E. Kraght; Published by Cornell Maritime Press. 148 pp. Price $2.25.

A START IN METEOROLOGY, by Armand N. Spitz; Published by Norman W. Henley Publishing Company. 97 pp. Price $1.50.

The authors of Meteorology, Theoretical and Applied have contributed a book long needed. It combines theory and practical meteorology advantageously. Too many elementary books have been published which have stimulated interest in this field but neglected the application of mathematical and physical laws and derivations. The book will be a valuable aid to the practicing meteorologist who desires to keep abreast of a rapidly advancing science. It also should prove an excellent general textbook for use in teaching.

The worthwhile addition of a chapter on "Statistical Analysis of Meteorological Data," Chapter 10, has given the student a chance to check up on his statistical research problems. The application of meteorology to everyday life is thoroughly discussed in Chapter 25, enabling a reader to see how meteorology is used in little known endeavors. It is highly recommended for teaching and review. A minor disadvantage is the use of the Tephigram instead of the widely employed Pseudo-Adiabatic Chart. It is true that the Tephigram overcomes the errors of the Pseudo-Adiabatic Chart but unfamiliarity with the Pseudo-Adiabatic Chart can be a disadvantage.

Mr. Kraght's book is excellent for beginners in meteorology. Text and illustrations provide a basic foundation for the reader who does not have higher mathematics and physics in his background.

Several mistakes in the book should be corrected, however. For example, the illustrations of altimeter changes are very good but the accompanying text is wrong. Altimeters in cold air give an indicated altitude below the real altitude while the conditions are vice versa in warm air. The lapse rate errors for altimeter settings also are reversed. The chapters on stability and instability are excellent in portraying the actual change in particles.

A more comprehensive geographical location of thunderstorm types and fog types as far as the United States is concerned might be added. The addition of one weather map to be analyzed by the reader with a discussion of the finished map might serve to illustrate some of the points of the book.

The book is an ideal supplement for the previous books of the author and might be used where the instructor wants to illustrate meteorology without becoming involved too deeply in theoretical discussion.

Mr. Spitz has prepared a very elementary book for use of high school and secondary school students. It appears to be too elementary for airline work and may even be too elementary for the general public's reading.

The illustrations are more for juvenile consumption. If they were cleared up slightly and additional complete illustrations added, a better book would have resulted. The best part of the book is Chapter X which states clear definitions of some of the involved relationships in meteorology. This book may be excellent for young beginners but appears too elementary for general usage.

E. O. MEYER,
Chief of Dispatching and Meteorology
American Export Airlines, Inc.

"Now what on earth makes you think we're flying upside down?"

SHORT VIEWS

AIRPLANE PROPELLER PRINCIPLES, by Wilbur C. Nelson, head, Department of Aeronautical Engineering, Iowa State College; published by John Wiley & Sons in 1944. 129 pp. Price $2.50.

An elementary treatment of propeller principles, including blade action theory, aerodynamic tests, blade and hub design and stress analysis, and effect of the propeller on plane performance.

BASIC AIRPLANE MECHANICS, by H. G. Lesley, superintendent of maintenance for Eastern Air Lines; published by John Wiley & Sons in 1944. 404 pp. Price $2.50.

Theory of airplane construction with directions for repair and maintenance of components. Construction materials discussed, standards of workmanship specified, routine procedures outlined and special precautions noted. Contains 329 illustrative figures.

DICTIONARY OF AERONAUTICS in five languages, compiled by Lothar Ahrens; copyright vested in Alien Property Custodian in 1943; published by Frederick Ungar Publishing Company. 562 pp. Price $5.

An American reprint of the pocket dictionary, "Aviation in Five Languages," published in Berlin in 1939. Contains compilation of 3,660 identical aircraft words, terms and phrases in German, English, French, Italian and Spanish. Has alphabetical index in each language.

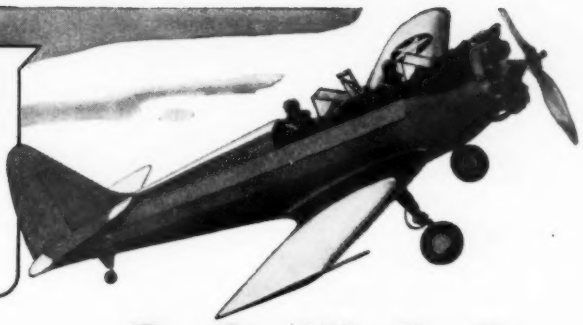
THEN THERE WAS ONE, by Eugene Burns; published by Harcourt, Brace and Company in 1944. 179 pp. with picture supplement. Price $2.50.

The story of the U.S.S. *Enterprise* and the first year of the war by an A.P. correspondent who "was there." For a while the *Enterprise* was the only major carrier available for combat duty in the Pacific.

THE RAFT BOOK, by Harold Gatty; published by George Grady Press in 1943; 152 pp. plus world and star charts and tables for emergency navigation. Price $3.25.

An expert navigator's account of how to survive on the open ocean and find your way by using principles of the Polynesian navigation methods. Birds and fish are identified and indications of land described from Gatty's intimate knowledge

Continental Red Seal Engines



POWER TO WIN

American Flyers are superbly trained. Their intensive training combined with native skill, resourcefulness and initiative, has produced the world's greatest combat fighters.

Continental Red Seal Engines are a very important part of this air force training. At just one of the many fields under supervision of the U. S. Army Air Forces, trainers powered by these famous engines are flying an average of more than 49,000 miles daily. Think this statement over carefully. It means nearly 18,000,000 miles a year.

This is just one of Continental's many contributions in its Power to Win program which will be relentlessly carried through to victory.

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AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA) with National Service Office located in the Carpenters Bldg., Washington, and Registrar's Office in the Michigan Square Bldg., Chicago, is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special Bulletin is sent each month to all registered AOPA pilots and also confidential memorandums from AOPA's Washington staff are sent members from time to time.

PRIVATE pilots are faced with a number of critical problems, and since AOPA's work is devoted solely to the problems of the non-scheduled pilot it is well to review AOPA's viewpoint on these matters.

LANDING STRIPS

Thanks to the war, the U. S. now has an abundance of "7-star" airports (over 900 of them) with mile-long concrete runways and facilities to match. When the peacetime taxpayer is asked for upkeep money, we may find we have even too many. So let's have a moratorium on building these multi-million-dollar airports.

But we are 'way short of low-cost airports which the private pilot needs *and which the private pilot can afford to keep up.* Eventually we should have one handy to every town of 1,000 or more population —an entirely sane and practical goal.

Within the next five years we ought to have 2,500 more of these small, low-cost airports, each one located where it will do a maximum of good to private flying. This is a practical goal to work toward.

AOPA will welcome advice from any member as to a definite location where such a low-cost airport is needed. In writing us, kindly state exactly why the site you have nominated is particularly good and useful. This information will be needed by the Government in deciding where to allocate funds.

In addition to low-cost airports, AOPA favors low-cost, one-way turf landing strips—and plenty of them. It favors having them alongside highways and close by service stations. AOPA does *not* at this time favor locating such strips where only a few pilots will ever use them. For the immediate future we want these strips favorably and smartly located for absolute maximum usefulness. After we get enough favorably located small airports, we will then be ready to spend excess funds on unfavorably located fields which will be useful in emergencies but which will not see much steady use.

Do you agree with this viewpoint? If not, let us hear from you. Some pilots do not favor landing strips because they fear cross-wind landings. We understand the armed forces have been forced to use many one-way turf airstrips by virtue of military necessity and have been considerably surprised to find that, when pilots get used to making cross-wind landings, it doesn't bother them.

RULES AND REGULATIONS

AOPA has pounded out thousands of words on this subject. To summarize, we *must* have a single code and a single set of air rules administered by the Federal Government rather than 48 separate state air codes, plus those which might be instituted by counties and municipalities. If necessary, to accomplish this we must have a good piece of federal legislation.

The single air code which AOPA calls for must be simple, it must be short, it must be reasonable, and it must be written in a language which the average pilot can understand without the advice of legal counsel. These rules must aim only to protect the public and not (as at present) to protect the pilot against himself. No rule can ever accompliish this.

Parts 60 and 20 of the Civil Air Regulations are now up for revision. Part 24, Mechanic Certificates, is soon to follow. All other Parts of the CAR pertaining to non-scheduled flying must be similarly cut down to a practical length and text.

AERONAUTICAL CHARTS

There are two problems regarding charts. First, aeronautical charts of the Coast and Geodetic Survey should be made available to all pilots who are licensed by the CAA and who hold pilot identification cards which are granted only after personal investigation has proven the holder to be a loyal American citizen. To deny such a civilian pilot the use of maps when he is flying cross-country is incompatible with the fines and punishments imposed against pilots who fly through danger and prohibited areas.

There is no possible reasoning which can dispute the simple fact that to avoid a danger area a pilot *must know where it is.* If the pilot is not given the charts which locate those areas, he cannot reasonably be expected to avoid them. The charts are classified as "restricted," which means that they *should be* available to any person who has reason to use them in connection with his flying, remembering that his loyalty has been investigated and proven.

The second problem regarding charts is that concerning minor changes in the manner of showing aeronautical aids which will make the job of navigating and of locating airports and airways aids easier to the non-scheduled pilot. AOPA's work on this project has been previously reviewed in detail.

COMPROMISE FINES

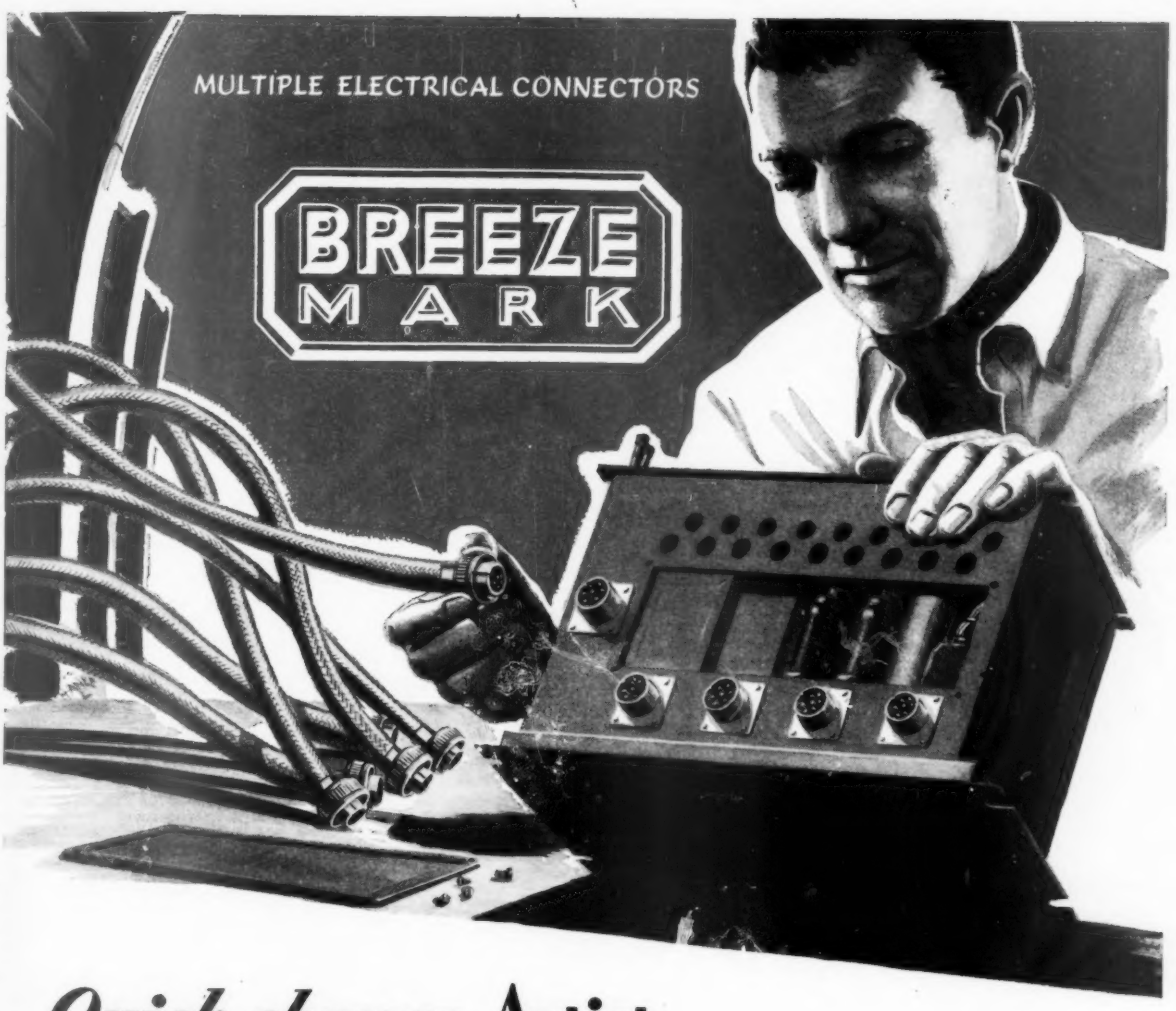
The Civil Aeronautics Act of 1938, which established the CAA, charged that organization with the promotion of aviation in the U. S. We thoroughly believe, as we have previously stated, that a single agency is needed to set up reasonable rules for the conduct of flying. We do not believe that the Civil Aeronautics Act of 1938 intended or provides for a glorified aerial police force, and we do believe that any pursuance of this policy will prove to be a destructive force in the growth of non-scheduled aviation and in the accomplishment of desired safety standards.

Specifically, AOPA believes that in recent months there has been a trend toward unnecessary penalizing of pilots on minor and technical infractions of the CAR. This problem is fanned into a general feeling of pilot resentment by the operation of a cafeteria-style fining system in which, after advising pilots of maximum possible penalties of thousands of dollars, a cut-rate compromise offer is made.

Pilots write to AOPA for advice as to what to do in this matter and it is exceedingly difficult to advise wisely. A fine of $25 to $50 is high enough to have an extreme nuisance value, yet low enough to invite payment merely as a means of settling a complex situation in the cheapest manner. Even when pilots believe they have been unjustly charged, they are frequently confronted with the prospect of seeking a hearing and fighting the case or paying the $25 or $50. The choice is pretty much forced upon the average person, as should be obvious to CAA officials, for most people of modest means would rather pay the nominal fine than accept the loss of income attendant to appearing before a hearing which, together with attorney fees and miscellaneous expenses, would far exceed the cut-rate offer. The fact that the violation remains as a permanent black mark against the pilot's record must be accepted as a by-product.

The problem is even deeper than this. Manpower shortages have obliged CAA to man many of their control towers with relatively "green" operators. However, these operators should not be given a free rein to "write up" violations. Unlike the normal legal processes and rights of an individual, a pilot, when charged with an infraction, is considered guilty until he has proven his innocence. A great responsibility, therefore, rests on those who are authorized to make such charges.

AOPA favors the old-time system of CAA personnel consulting with a pilot who has made his first mistake and assisting him by advice and counsel. Legal proceedings and fines should only be resorted to in extreme cases and then only for habitual offenders or irresponsible pilots. Unless this policy is immediately adopted in lieu of present practices, all of the remaining wartime incentive for civilian flying will soon be trampled to the ground—by the organization supposedly carrying out the mandate of Congress to *promote* American aviation.



Quick change Artist

Breeze Multiple Electrical Connectors Save Time in Servicing and Maintenance

Speed of overhaul and replacement of vital equipment is an important factor today in the efficient operation of both military and commercial aircraft. It is a factor which depends in great part on the speed with which hundreds of electrical connections can be made or broken. Breeze Multiple Circuit Electrical Connectors provide a solution to this problem, making it possible to connect or disconnect from 1 to 47 circuits instantly and simultaneously.

Manufactured in a wide range of types and sizes, Breeze Connectors are designed to meet practically every need in modern electrical control and communications systems. Produced in quantity to latest A-N specifications, these Connectors supplement the well-known Breeze line of aircraft accessories that are playing such an important part in the United Nations' drive to Victory.

Cutaway view of Breeze Connector showing simple design and split-case construction.

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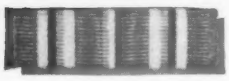
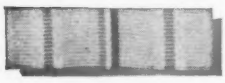
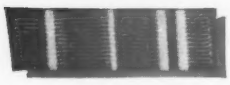


American Theatre



Asiatic-Pacific Theatre



European-African Middle Eastern Theatre

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At better stores everywhere—Bancroft Cap Company, Boston, Mass.
Write for free booklet: HOW TO CARE FOR YOUR BANCROFT CAP.

Jungle Emergencies

(*Continued from page 45*)

in or near enemy territory, burn the plane.

Travel in the jungle forest is slow. Try to follow a stream downstream. Stick to natural trails or native trails as far as possible. Don't try to break your way through.

If you can't find a stream or native trail, follow the swampy hollows which generally run in chains and eventually join a stream.

In hilly country, the ridges are easier to follow than the valleys but precipices may make long detours necessary.

In elephant country, follow the elephant trails. Elephants never go where they are likely to fall or get bogged. Elephant trails are three or four feet wide, other game trails are a foot to 18 inches wide.

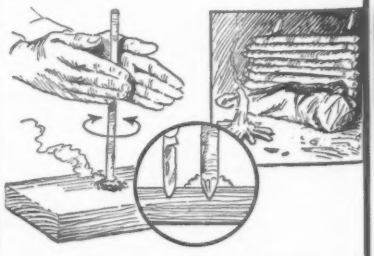
You can't look through the jungle, but sometimes you can look under it. The heavy foliage generally ends about a foot above the ground. Often you can see more by getting flat on your stomach than by standing up.

Rely on your compass and your map but don't try to follow a direct compass line. It will take too long and be too tiring.

Do your walking early in the day. By five in the afternoon very little light can penetrate. Start looking for a place to camp around three or four.

Take plenty of time for sleep and rest. Don't force yourself.

In picking a camp avoid the banks of streams and rivers. Pitch your tent back a few hundred feet. Try to find a slight rise. Half way up a hill is good. If jungle growth separates you from the stream, all the better.



Build yourself a fire every night. Even in rain forests comparatively dry wood can be found hanging in the network of vines and rattans. Any standing dead trees will be dry inside. Wet wood can be split and the heart wood dug out. If you are in palm country, scrape the fuzz from the bottom sides of palm leaves for tinder. (*Continued on page 90*)

"Weight Saved On a TWA Plane Worth $173.00 a Pound in 1943"

SAYS J. C. FRANKLIN
Vice Pres. of Engineering
Transcontinental & Western Air, Inc.

"SINCE September 9, 1943, the standard operating weight of TWA DC-3 aircraft, consisting of airplane, crew, oil, full equipment and meals, has been decreased 261 pounds per aircraft for summer operation and 279 pounds per aircraft for winter operation.

"Interpreted in terms of payload space, which TWA valued at $173 per pound in 1943, we have found that this weight reduction program has given us the equivalent of an additional DC-3 for our entire fleet of Skyclubs."

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Comparative weights of various types of self-locking nuts comprehensively reviewed for the convenience of aircraft designers, engineers, operating and maintenance personnel. Copy will be sent you, free, on request.

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Boots Aircraft Nut Corporation, General Offices, New Canaan, Conn., Dept. N

BOOTS NUTS SAVE UP TO 60 LBS. PER PLANE

- Much lighter yet far tougher than other nuts.
- Standard fastenings on *all* types of military fighters, bombers, cargo carriers.
- In peacetime will be standard on commercial planes.
- Can be used over and over again.
- "Outlast the plane."
- Approved by all government aviation agencies.

This is one type of the famous Boots All-Metal Self-Locking Nut—set in straight or curved channel for fast assembly.

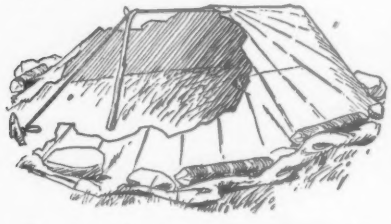
(*Continued from page 88*)

A simple fire maker can be made from a flat stick of soft wood and a foot and a half length of fairly hard sapling about ⅜-inch in diameter. Bore a cone-shaped hole in the stick with your knife and whittle a similarly shaped point on the end of the sapling. Put the point of the sapling in the hole, pile palm leaf tinder around it, and twirl the stick back and forth until tinder catches.

Before settling down for the night, gather a good supply of firewood and stow it inside the dry tent.

Build your fire small. Nearly all natives in the tropics arrange the wood in a radiating pattern, like the spokes of a wheel.

In just about 99 cases out of 100, jungle animals will be just as frightened of you as you are of them. If you want some form of protection at night, build a fire and pile on bamboos. They will go off like gunshots and scare away any nearby animals. In an emergency, a shot from your signal pistol will scare off an angry elephant or tiger.



Warning: One of your worst enemies in the jungle is the mosquito. Never go to sleep without some sort of protection. Either cover the upper part of your body with it, taking care that your hands and face don't touch the netting, or use it as a covering for the tent door. Be sure to kill all mosquitoes inside the tent after you have closed the netting door. In addition, apply mosquito repellant to your face and hands. Put a good quantity behind your ears.

Natural food is plentiful in most jungles if you know where to look for it and can distinguish between the edible and the poisonous. There are only three general rules beyond definite recognition:

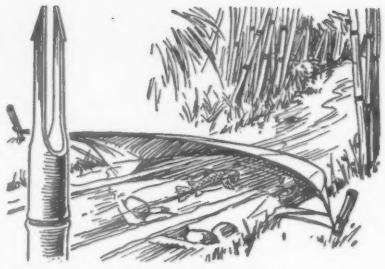
1. Eat nothing that has a bitter taste unless you are sure what it is.
2. Avoid plants having a milky sap.
3. Anything that you see monkeys eat, you can eat.

Fish are easy to catch in most tropical streams. A hook and line will generally bring results, but a spear made by whittling sharp double points on a bamboo shaft or a small sapling will yield more food in less time. If both of these methods fail, your parachute-tent can serve as a fish net. On small streams it can be spread across a narrow portion to trap fish as they swim downstream.

Don't eat any fish that have spiny or leathery skins. Skin all fish and frogs before cooking.

Fish should always be boiled, not only as a precaution against infection but to retain more of the food and vitamin value of the fish than either frying or baking.

Ground birds and small jungle animals require more time to catch and prepare than fish. The most common are ground

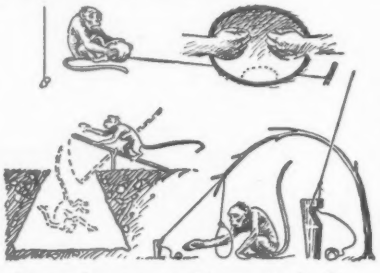


pigeons, turkeys, jungle rats and monkeys.

Simple snares and traps [those for monkeys are shown below] are about the best means of catching these animals. They can be set out at night when camp is made and taken up in the morning.

Don't overcook meat, and use as much of the animal or bird as possible. Entrails, the heart, the liver and the kidney contain essential vitamins that will make up for any possible lack of greens and roughage in your diet.

As with fish, meat should be stewed rather than fried or baked. Chunks of meat one or two inches across should be dropped into a pot of cold water over the fire. Two minutes after the water has come to a boil remove the pot from the fire and place it to one side to cool. This permits the meat to cook thoroughly yet prevents over-cooking.



If you have no cooking pots, food can be baked by wrapping it in several layers of green leaves and burying it in hot ashes, keeping the fire on top burning until cooking is completed.

A similar but cleaner method is to place a number of very hot stones in the bottom of a shallow, dry trench scooped in the ground. Cover the stones with green leaves, place the leaf-wrapped food on the leaves, surround it closely with other hot stones, and cover the whole thing with more hot stones and a light topping of earth. It will take about two hours for most foods to cook.

Game or fish can be cooked on an improvised spit or stick.

Fat should be part of your diet. Save unused fat from animals killed. It may not always be possible to get birds and animals, so a reserve of protein and fat should be carried. Melt the excess fat in a pan, boil it for a few minutes, skim off any solid material, and pour it into a small can with a tight-fitting top—one or two empty friction-top coffee containers from your emergency ration kit will serve nicely. The fat then can be used for preparing starch plants and other foods.

In emergencies, two groups of jungle insects form a nourishing food source:

In most clearings and grasslands termites emerge from the ground and can be picked up by the handful after a heavy rain. Remove wings and eat raw or fry in fat. They are considered delicacies by jungle natives. Grasshoppers and crickets also can be eaten.

Beetle grubs are a favorite native food. They can be found by hunting out dead stumps and fallen trees and listening for the scratchings of grubs inside the wood. Once grubs are located, split the log with your jungle knife and remove them. Dried in a pan suspended over a fire, they can be eaten as they are, as part of stew made up of one of the starch root plants, or they can be fried with a little salt and fat.

Four *poisonous* plants are:

SANBOX. The tree grows tall and has a trunk covered with spines. The fruit is about four inches in diameter and resembles a small pumpkin, being green when unripe and brown when ripe.

MANZANILLO. Found near the seacoasts along beaches. The bark is smooth and tan, the leaves are green, and the fruit resembles a small green apple.

COWITCH. A plant common in thickets. The beanlike pods are not edible and should not even be touched. They are covered with short, fine detachable hairs that will cause severe irritation.

STRYCHNOS. A slender, woody vine bearing ball-shaped fruit about two inches in diameter. It contains one of the deadliest poisons known.

Three things are absolutely necessary to your health—periodic doses of quinine or atabrine, the use of some sort of mosquito protection, and daily doses of salt or salt tablets to replace the salt removed from the body by excessive sweating.

Take the first dose of atabrine (one tablet) in the morning, and the second dose (one tablet) in the evening on the first day you are in the jungle. Skip three days, then repeat the doses as on the first day. Keep this up as long as you are in a malarial area. (This dosage for one and a half grain atabrine tablets.)

If quinine is in the jungle kit instead of atabrine, take two five grain tablets each day, as long as you are in a malarial area.

Dysentery caused by impure drinking water or food can be avoided by purifying all drinking water and by eating only food which has just been cooked or taken from a sealed container. If you become ill with dysentery, take only liquid foods and stay as quiet as possible until you are well. Add two salt tablets to each canteenful of drinking water.

If your first aid kit contains sulfaguanadine tablets take four tablets every four hours, day and night, until your bowel movements are normal. If there is no improvement in four days, stop taking the tablets.

Snake venom acts rapidly. Put a tourniquet on at once, placing it between the body and the bite. Apply it above the knee in foot or leg bites, above the elbow in hand and arm bites. The tourniquet should be loosened for 10 or 15 seconds every 20 minutes.

Apply iodine around the bite, treat your pocket knife blade tip or razor blade with iodine, and make cross incisions one-

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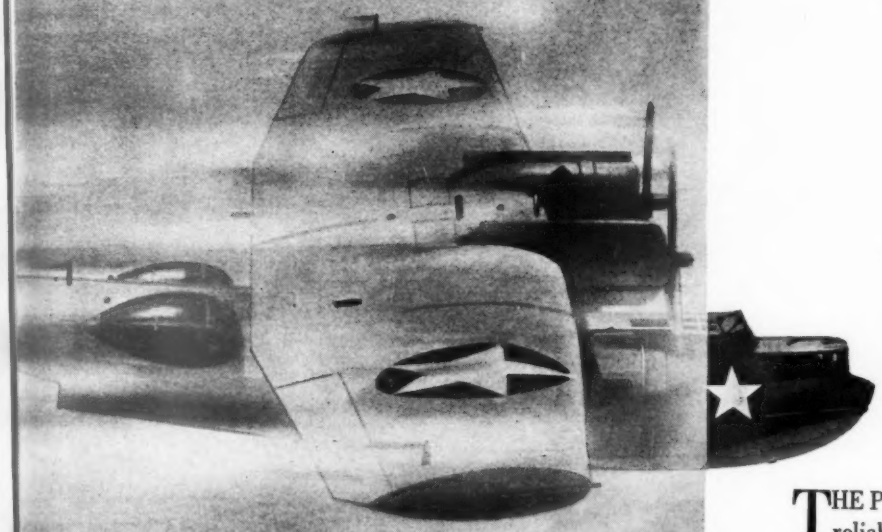
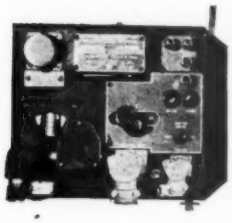


BUY MORE WAR BONDS

RCA Aviation Radio Transmitter used in the PBY Catalina



RCA Aviation Radio Receiver used in the PBY Catalina

THE PBY Catalina has become a synonym for reliability—long staying power—the ability to go anywhere, in any weather—to accomplish the most difficult and lonely missions—and to come back!

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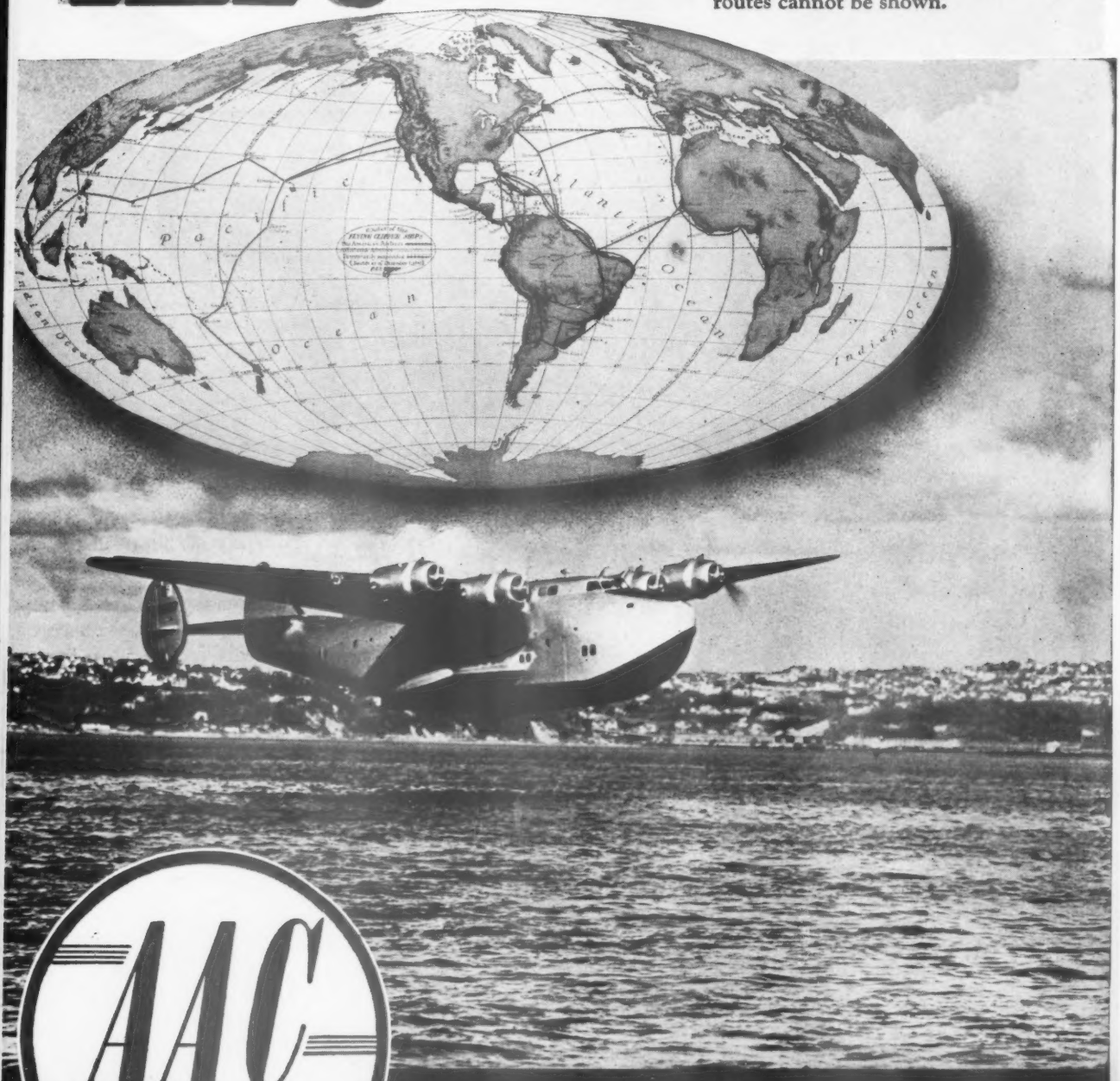
* The Pan American World Airways routes shown below are those in existence on December 7th, 1941. Present routes cannot be shown.



AAC Products

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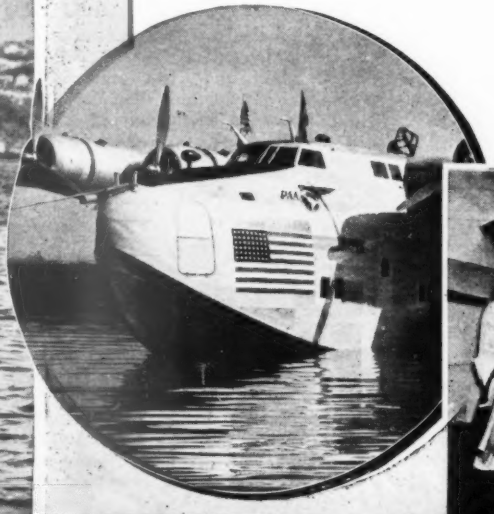

In war as in peace the PAA Clippers serve humanity. Here 1810 pounds of medical supplies go aboard at LaGuardia Field.

(E-54)

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(*Continued from page* 90)

fourth inch long and one-fourth inch deep across each fang mark. Then apply suction to the wound for 20 minutes before loosening tourniquet and keep up suction for at least three 20-minute periods. This can be done by mouth if you have no snake bite kit. Spit fluid out.

After the wound has been sucked for an hour, remove the tourniquet, apply iodine or sulfanilamide powder if you have it, and apply a clean bandage.

Ticks, fleas, body lice, mites or chiggers, kissing bugs and botflies carry serious diseases or cause painful sores. Leeches and vampire bats (only in South America) also are dangerous.

Remove your clothing twice a day and inspect it and your body for any trace of vermin.

Ticks can be identified by their flat oval body, small head, and comparatively large abdomen. They are carriers of relapsing fever and typhus.

Never squash a tick on the skin or attempt to pull it out. Instead, cover it with a good coating of spit. The tick will free itself and be easy to remove. If you try to pull the tick out, his mouth will be left under your skin. Apply iodine to the bite.

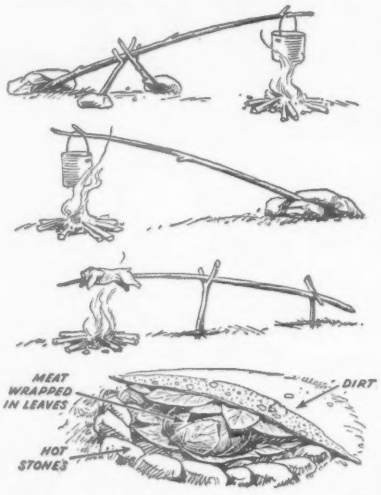
Avoid native huts and use your insect repellant.

Chiggers bore under the skin. They should be removed with a sterile knifepoint and the bite treated with iodine.

To keep from getting lice, avoid close contact with natives and stay out of native huts. It is easy to kill the lice, but the eggs are more resistant. Steaming of the clothing, especially the seams, generally will be effective.

Kissing bugs are large, dark brown and black, having a narrow cone-shaped head, oval body, long legs, and well-developed wings. Common in Yucatan and Central America, they are carriers of Chagas' disease. They usually bite you on the face, so again mosquito netting is an important protection.

Botfly maggots burrow into the skin and cause a painful swelling that looks like a boil. A coating of oil or kerosene



placed over the hole every few hours will generally cause the larvae to come to the surface of the skin where it can be expelled by squeezing the skin. Frequent applications of wet tobacco will also kill the larva which can then be squeezed out.

Leeches live in sluggish water or cling to low-lying brush and attach themselves to a passing man or animal. Unless removed carefully, their bites can produce painful infections.

Do not remove a leech by pulling. Instead apply iodine, salt or tobacco juice and it will release its hold and drop off.

Vampire bats, found in Yucatan and tropical America, often bite humans and are carriers of rabies and other animal diseases that infect humans. Immediate first-aid treatment consists of cauterization of the wound and applications of tannic acid ointment and a tight compression bandage.

With the exception of those in New Guinea and in parts of Assam, there are few dangerous jungle natives. When you encounter natives, try to appear confident but not aggressive. Stay away from the women. All natives are superstitious and suspicious. You can only win their confidence by appearing open-handed.

String tricks—the cat's cradles and spider webs that you did when you were a kid—are an almost universal pastime with jungle natives all over the world. If you remember any of them, pick up a piece of pliable vine and demonstrate them to natives you meet. In most cases it will serve as an immediate bond between you and them. If you can't do a string trick, go through the motions to arouse their curiosity.

Be particularly careful of your treatment of natives if you are in or near enemy territory. They can help you get back to your lines. Don't try to use terrorist methods.

Eat native food only when it has been well and freshly cooked and be sure all water offered you by natives has been boiled. Under no condition sleep in or near native camps or bathe in nearby streams. Avoid close contact with any native. Don't go around barefoot. END

Factory Medico

(*Continued from page* 51)

mount to a staggering total. It's only natural that if proper medical attention is given the workers in regard to immunizing them as much as possible through planned vitamin consumption, their chances of losing time through ordinary head colds has been slashed considerably. The war worker's physical stamina is increased and the trials and tribulations of the sneezes and sniffles is lessened.

The benefits derived from proper vitamin dosage are explained to the workers at Curtiss-Wright through the medium of posters. The vitamins are sold at cost. That Curtiss workers realize the benefits derived from vitamin consumption is proven in the fact that more than 125,000 vitamin tablets are sold monthly.

"It's a well-known fact that the healthier the individual the greater is his resistance to disease and the less likely he is to contract an illness," said Dr. Good. "Vitamins are a good build-up for the body. They also act as a tonic. I feel that through the vitamin sales a great percentage of illness has been eliminated. Consequently, Curtiss-Wright turns out more warplanes."

Maintaining a 24-hour medical service schedule, his staff of 42 nurses, 11 doctors, one laboratory technician and two X-ray and laboratory technicians, are equipped to handle all emergencies from an appendectomy to a leg amputation. All phases of the Curtiss-Wright hospitals are expanded as employment increases.

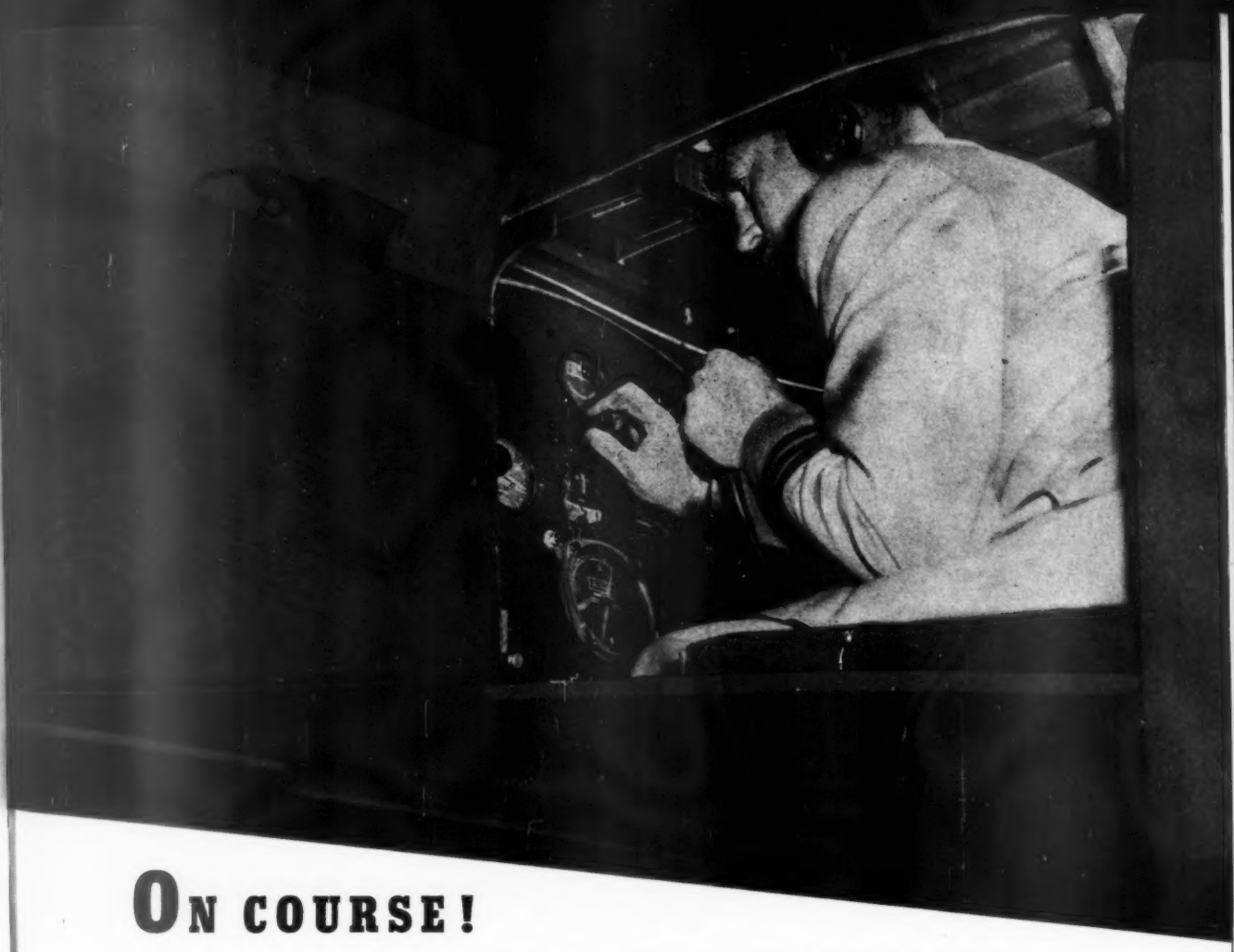
A graphic illustration of the continual effort toward saving valuable man hours was recently demonstrated by the medical department. Men and women working on machines where a certain type of oils were used, were coming down with a skin eruption known as dermatitis. The epidemic reached unusual proportions in man hours lost, plus the discomfort of the disease.

The medical staff went to work on the problem. They experimented with and introduced a solution known as Ply No. 9 which corrected the trouble. Rubber aprons were provided and the cases of dermatitis in the lower extremities were reduced. In shops where airplane parts are dipped in various paints the introduction of a Resistoflex glove to be worn by workers during the paint dipping operation completely overcame the disease. A recent survey showed that the dermatitis epidemic was checked with no new cases being reported. The man hour saving through the medical department's alertness was tremendous.

It is Dr. Good's belief that infection in industry claims more lost time and man hours than any other type of injury. Aluminum, used extensively in building airplanes, contains a protective covering. When a worker cuts himself on aluminum, this aluminum film has a tendency to cause a dangerous infection *after* the wound has healed. Through proper care and treatment of simple cuts, the Curtiss medical staff has reduced infections from better than five per cent to less than one per cent.

The medical department with its patients ranging in the thousands, handles many unusual cases. Dr. Good tells of one such case as illustrative of the complexities involved in industrial medicine. "This particular worker was hired about six months ago. He was placed in a job where occasionally he would come into contact with oil. As he possessed a remarkable skin sensitivity, the oil caused his skin to erupt and it was found impossible for him to work in those particular surroundings. We recommended he be put on another job, away from the oil. But he continued to break out in an irritating rash. We dug into the case and found that the fellow was extremely

(*Continued on page* 98)



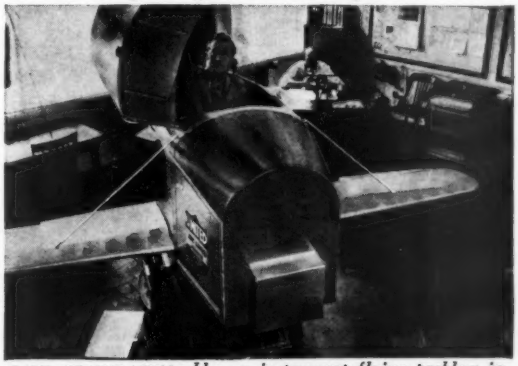
ON COURSE!

You may have to explain the picture to non-flyers. It is not an airplane. Capt. Albert "Pinky" Stainback, veteran United Air Lines pilot, is at the controls. He is approaching a Pacific Ocean port, with visibility zero...in the Link Trainer.

Stainback notes that his altitude is 1,800 feet, air speed 160 miles per hour. The rhythmic dot-dash of the Morse "A" in his earphones is merging smoothly now with the dash-dot of the "N" signal, which tells him he has found the "on-course" signal. He is on the beam.

Veteran "Pinky" Stainback knows he has to follow the beam to the "cone of silence," a dead spot of radio. When the beam hum dies off to silence and then resumes, he has his exact location with respect to the airport. Following instructions from the airport control tower, he now is prepared to land.

Thus United Air Lines pilots practice approaches to distant ports in the Link—without leaving the ground! Thorough training in instrument flying has served United's pilots well—on 880 Pacific Ocean crossings in 1943, flying men and materials to faraway fronts. United crews also chalked up 2,400 military flights in the Western Hemisphere last year, besides flying the company's regular nation-wide passenger, mail and express schedules.



CAPT. STAINBACK tackles an instrument flying problem in the Link at United Air Lines' San Francisco terminal, under the watchful eye of Link Instructor Lyman Ellis.

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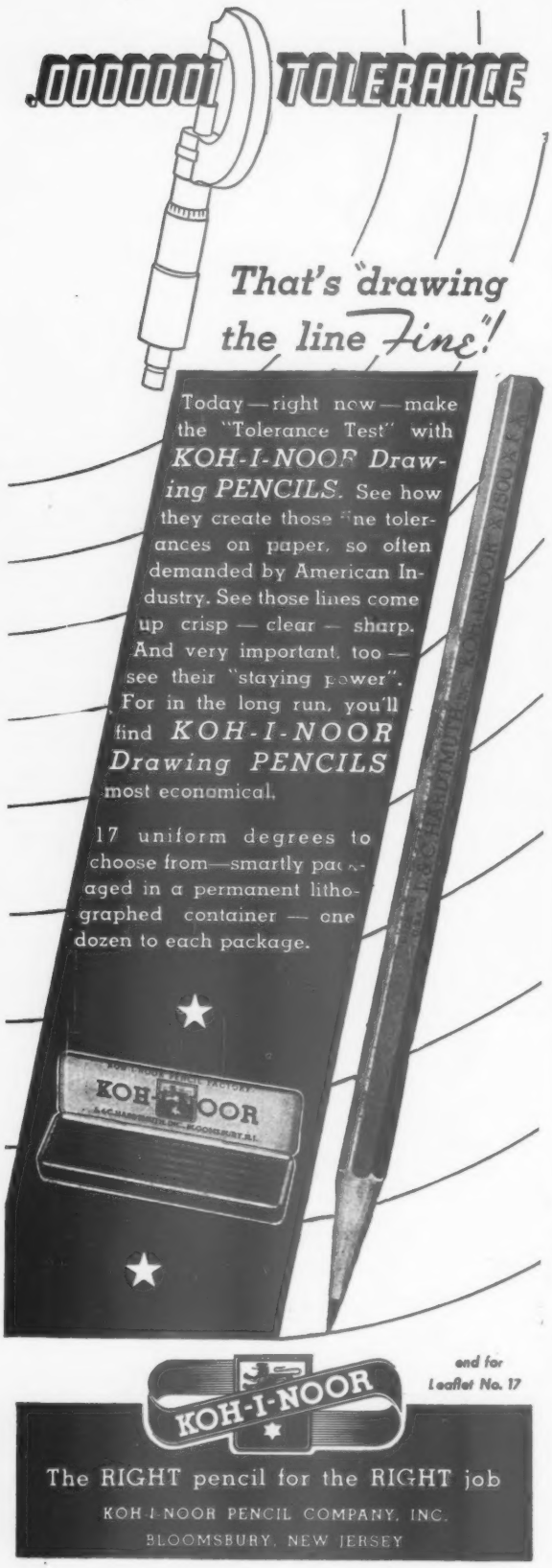
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(*Continued from page* 94)

allergic to aluminum, of all things. If he merely brushed against the stuff he would break out. We tried placing him in different jobs—but in an airplane plant it's pretty hard to stay away from aluminum. The man was willing enough to work, but with this allergic condition he was a drag to the war effort working in an airplane plant. We recommended that he be placed in some other industry where he would not come in contact with aluminum or oil. A recent report from his new employer seems to indicate that the man now is a definite asset to the war effort."

An absenteeism problem was encountered with thousands of women workers entering the Curtiss plants to work on the production lines. Unaccustomed to this new type of work, many of the women workers were suffering from tendon and muscular strain with the consequence that they were laying off in order to allow their sore muscles a chance to recuperate.

The medical staff solved this grave problem by setting up a system whereby many of the new women workers were given electric massage and therapeutic treatment under the expert hands of trained nurses. The newly acquired aches and pains vanished under this trained muscular manipulation. The rising absenteeism in the new women employees dropped sharply.

Warplanes are thick in the skies above the Curtiss-Wright plants—screaming, sleek Curtiss-Wright *Warhawks*, and huge, twin-engined *Commandos*. The percentage of crash landings is negligible but they do occur occasionally. Dr. Good's staff is continually on the alert and is completely equipped for such an emergency.

An emergency arose last summer when a *Commando* with crew and passengers aboard remained aloft for nine hours, unable to land because of landing-gear trouble. The big plane circled the field for hours. The radio chattered. Efforts were made to repair the landing-gear but without success. Finally, its gas supply running low, it was decided to attempt a belly landing.

Dr. Good and his medical staff had not been idle.

Called immediately to the flying field when the damaged landing gear had been discovered, Dr. Good supervised all proceedings. A hospital hut was set up right on the field. Cots, stretchers, bandages—all medical and surgical supplies—were in readiness, alongside of the fire-fighting equipment and crash crew. An ambulance purred at attention. Dr. Good paced up and down in front of the ambulance, hands jammed in his pockets, head back, watching the plane in the sky.

"We were ready for anything," said Dr. Good. "But Herb Fisher, pilot of that *Commando*, brought the plane down in a perfect belly landing. The only injury that day," he added, grinning, "was to the medical staff. A 'beaut' of a sunburn and an epidemic of stiff necks from gawking up at the sky."

Realizing that illness and injury in today's vital war industry can be a definite saboteur if allowed to exist unchecked, the War Department stated recently: "Accident prevention is one of the primary interests of this section (AAF Materiel Command, Eastern Procurement District) and it is felt that co-operation in worthwhile programs which aid in reducing time lost due to accidents is more desirable in order that productive effort may be maintained at the highest possible level."

In strong accord with the view expressed by the War Department, the medical department at Curtiss-Wright (in co-operation with the Curtiss General Safety Committee) have set up and is maintaining a daily routine planned to reduce accidents through education of workers by means of safety bulletins, posters and other media.

The Safety Committee is composed of foremen and executives from the various departments. Tours of the plants are conducted regularly by members of the committee, which also includes members of the medical department staff. The inspection tours are made slowly and carefully, with an eye to hazards that could mean injury to some worker. Conditions that might be detrimental to the well-being of the worker are noted and a report is made which is circulated throughout the plants. Conditions included in the report and labeled as "danger signs" are rectified.

A typical Safety Committee report is no mere collection of a few facts. The report is detailed and contains on an average of 75 detected hazards and suggestions for installations of safety guards or methods of "dehazarding."

(*Continued on page* 101)

Preview of a new Bell Fighter*

* *Described by the Office of War Information as "A new Bell fighter, now in production, with a low drag wing and a two stage, supercharged Allison engine which will make it an efficient plane at any altitude up to 38,000 to 40,000 feet."*

When the Axis powers get their first view of this U. S. Army fighter, just beginning to come off the production lines in our Niagara Frontier plants, they'll see it as a slim, trim, single-engine plane. They'll learn next that it has blinding speed... that it can fight effectively high in the sky... or blast troops and tanks from tree-top level. Like the Airacobra, "Cannon on Wings," this plane has plenty of firepower. It throws a paralyzing barrage of machine gun bullets and cannon shells.

Manufacturing this new fighter is one part of Bell Aircraft's war job.

Now add four more chapters—(1) building flexible gun mounts for planes and surface ships; (2) designing and building America's first jet propelled plane; (3) developing the new Bell Helicopter; (4) producing bombers in Georgia—and you have the complete story of Bell Aircraft's war effort.

Yes, Bell is concentrating to speed the day of peace. And the lessons we're learning today mean that you can aim *high* when you think about post-war aviation. © Bell Aircraft Corporation.

MEMBER AIRCRAFT WAR PRODUCTION COUNCIL—EAST COAST, INC.

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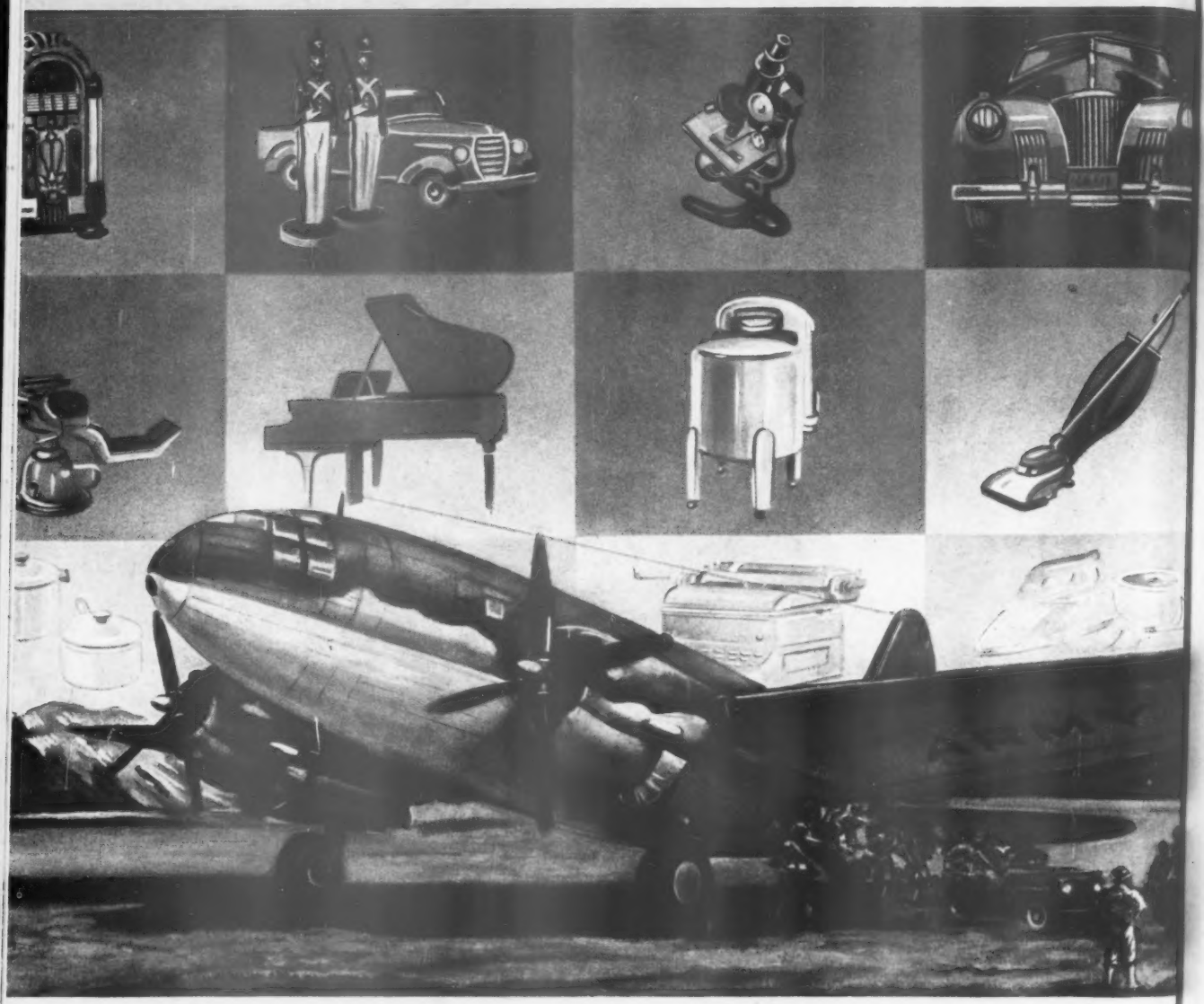
BUY WAR BONDS AND SPEED VICTORY

THAT OUR COUNTRY MIGHT *Out-Produce* THE ENEMY



Hundreds of Peacetime Producers Mobilized by CURTISS for Victory

Convert or quit! That was war's ultimatum to a great many American manufacturers. Thousands of them had scarcely digested this, "Get into war work or get out of business" edict before Curtiss-Wright representatives were at their doors.

We offered them, as Curtiss-Wright subcontractors, a way to survive . . . a means of contributing to the war effort . . . a method of holding their organizations together until they could return to peacetime products.

Into each plant came Curtiss-Wright men to help solve complicated conversion problems—to assist in installing new machinery, training workers, mapping schedules, meeting quotas.

Thus did Curtiss-Wright, by the speedy organization of a vast subcontracting system, not only protect hundreds of small manufacturers from finding their businesses listed among the casualties of war—*but—took a stride that quickened the production of vitally needed aircraft and vastly accelerated America's war effort!* LOOK TO THE SKY, AMERICA!

Another Contribution of

Curtiss-Wright Corporation

AIRPLANE DIVISION

Toward Winning This War

BUFFALO · COLUMBUS · ST. LOUIS · LOUISVILLE

Member, Aircraft War Production Council, East Coast, Inc.

(*Continued from page* 98)

A sizable percentage of injuries suffered in the plants is to the toes and feet. A die slips from a worker's hands as he's sliding it into a punch press. A die is heavy. It causes considerable damage to a man's toes if he drops it there. Fractured toes are not uncommon.

"There was a time when a fractured toe meant disability," said Dr. Good. "The worker was laid up or at his best could barely hobble about and suffered considerable pain. Today, however, through the use of a metatarsal bar constructed across the shoe of the injured person he can not only work without any lay-off, but he suffers hardly any pain."

In these days of increased production demands, it is imperative that workers be kept on the job even though their productive capabilities might be lessened due to a minor injury.

"A man with one good arm is better than no man at all," is the general opinion. It's pointed out, however, that if the injury is of sufficient seriousness the worker is not allowed to come to work. But modern medical skill and an elastic system of job allotment, such as in effect at Curtiss, makes it possible to keep injured workers on the job who, in the past, would have been forced to lay off.

"Take a man with a simple fracture of the arm, for instance," say these industrial medics. "In the past such an injury meant complete disability due to the fact that the worker was unable to perform his customary duties to the fullest extent. Today, if a worker is injured, he is 'reprocessed.' His injured arm is immobilized in a cast. If he is a machine operator he naturally can't continue on with that type of work until his injury has healed. But there are numerous other jobs that a man with one hand is quite capable of performing, especially if that man has the shop training and knowledge that is invaluable in industry today. He is fitted into any one of a number of jobs. He becomes a dispatcher, or a clerk, or in some cases an instructor. There is always a spot for a man even though he can't perform his customary duties."

Curtiss medical department records show that the majority of the workers injured on the job lost no time from work other than the time required to properly treat their injuries. They continued working, if not at their own job then doing some type of simpler duties equally vital to the war effort.

Injury to the eyes constitutes a large portion of the injuries treated by the medical department. Workers are urged to wear goggles at all times when engaged in any job that might injure the eye, but in many cases, through negligence or carelessness, eyes are not protected and injuries result.

In a recent directive, Dr. Good states: "It is the opinion of myself and of prominent oculists that the wearing of protective goggles is not in any way harmful to a person's vision, regardless of whether he is wearing glasses or not. The only complaint an employee could have is the discomfort of wearing a heavy pair of goggles, and this objection cannot be compared to the protection it affords the employee. I strongly recommend that supervision insist that goggles be worn."

Dr. Good's recommendation is based on sound facts. In an analysis of eye injuries suffered by workers in the plants, it was estimated that in one month, 280 productive man hours were lost because of eye injuries. Two hundred and eighty man hours is equivalent to six men staying at home for one week, or the installation of five *Warhawk* engines.

Besides these out and out lost man hours, there were 966 minor eye injuries reported to the medical department. A minor eye injury which keeps a worker idle for half a day costs an average of $8 in unproductive time, idle machine hours and first aid attention. Multiply this factor by the number of minor eye injuries and you have a cost of $7,728—which would pay for over 5,100 pairs of good safety goggles.

Cuts and bruises, no matter how inconsequential they may seem at the time of the injury, are treated immediately at the clinic. Supposing a worker cuts his finger on a piece of aluminum. Aluminum is highly infectious due to the chemical treatment used in processing it. The worker shrugs off the injury, continues working, perhaps wrapping a piece of waste about the wound. His foreman spots him. "Down to the hospital with you, chum," says the foreman, and gives him a hospital pass and a foreman's accident report form.

(*Continued on page* 102)

THE TORCH THAT BUILDS A CRADLE!

The engines powering many of America's deadly fighters are locked secure in cradles of steel... motor mounts built by Skylark. Designed and engineered by experts, Skylark's craftsmen weld these incredibly strong steel tube motor mounts exact to the hairsbreadth. By knowledge of forging and precision welding of motor mounts, bomb racks, control systems, and other vital airplane parts, Skylark craftsmanship is helping American Air-Borne Craft to Victory today. Consult Skylark on problems of tooling, fabrication, assembly, processing and design.

SKYLARK *Craftsmanship* TOMORROW

At the war's end, Skylark's skilled, experienced operators and precision facilities will be immediately available for peacetime production of airplane parts.

Plan now to use Skylark's craftsmanship tomorrow, when "bombers" become transports, and "pursuits" become pleasure craft.

SKYLARK
AIRPLANE PARTS
CRAFTSMEN
SINCE 1934
Skylark Manufacturing Company Inc.
Venice, California

The worker reports to the file clerk at the hospital. She takes his accident card, checks his record and number, passes him quickly into the infirmary. A nurse cleanses the wound with soap and water, irrigates with normal saline and, using a powder blower, covers the wound with sulfathiazol powder, after which she binds the finger. She writes the record and treatment of the injury on the card. All employees are given a surgeon's treatment card with the date they are to return for further treatment indicated on it.

"Come back tomorrow for re-dressing," the nurse tells the worker. He protests. "Now look, miss, I just cut my finger—I didn't cut it off!" The nurse's lips iron out but her eyes twinkle. "Come back tomorrow," she says firmly. "Hand that card to the file clerk on the way out." She turns to the next patient awaiting treatment.

The man with the injured finger came back the following day for treatment—and the next day, too, if the hospital deemed it necessary. Infection is greatly reduced. Through disregard of his slight injury there's the possibility that the worker might have been laid up with a serious infection—he might have lost a finger—he might have lost an arm. The medical staff takes no risks. Infection of wounds has been so reduced at Curtiss-Wright plants that it is only the exceptional and usually unreported injuries that develops this complication.

Pre-employment physical examinations tend to reduce illness among future employees of Curtiss-Wright. All prospective employees undergo a rigid physical. Heart, eyes, ears, nose and throat are examined by one of three doctors. They are vigilant for an indication of contagion. Signs of rupture are watched for and tests are given to determine whether or not such a condition exists or is likely to be induced by any physical exertion. A urinalysis is taken. Women are examined separately at a clinic designed especially for that purpose. An average of 5,500 employment applicants are examined monthly.

The role of a factory medico is decidedly no one-horse shay affair. The health and well-being of thousands of war workers depend upon his ability and judgment—and it is imperative that they be kept on the job. END

Multi-Million Miler

(*Continued from page 69*)

Russia in 1914, Iwan developed his own ideas on how he wanted to spend the next few years. His father did not agree so Iwan ran away. One month later the police, spurred on by his irate parent, found Iwan a full-fledged soldier in the 96th Omsk regiment, which was preparing to meet German pressure after the battle of Tannenberg—a major defeat for the Russians in 1914.

Following battles along the Vistula River, where the Germans were finally held, young Smirnoff was awarded the Cross of St. George for wiping out an enemy machine gun nest while on patrol in No Man's Land. Sometime later, severely wounded, he was taken to the base hospital in Petrograd (now Leningrad), which was situated in the very university to which his father had meant to send him.

While recuperating in this hospital, Iwan was struck by the smart appearance of a group of air force cadets whom he could see training in a neighboring field. He had only vague ideas about flying but he possessed very definite convictions on the subject of good appearance. And so, as soon as he was cured of his wounds, he joined the Russian Imperial Air Corps.

Toward the end of 1915 he mastered the art of manipulating the flimsy planes of World War I. In those days three and a half hours' instruction was enough to turn a man loose in one of the Caudromes, Farman-Goliaths or Moranes at the military flying school. A gasoline cock and an ignition switch were the only instruments needed to help a pilot solve the difficulties of whizzing through the air at 35 m.p.h. One to five hours' flying time at the controls made him a fully qualified pilot.

Wearing his new officer's uniform—a splendor greater than he had dared hope for during his hospital days in Petrograd—Smirnoff went to the front as a pursuit pilot, flying even "faster" models at the breakneck speed of 50 m.p.h.

He did very well. Within a year and half the Germans lost 12 planes to him—Rumplers, Aviatiks, Albatrosses. The Russians conferred upon him all the distinctions they had available and when he still continued to shoot down Germans, the French pilots, who flew wing to wing with the Russian squadrons, saw to it that Smirnoff was awarded the Croix de Guerre and given the right to use the title: "As des As" (Ace of Aces).

When the Kerensky government concluded a separate peace with Germany in 1918 (the peace of Brest-Litovsk), Smirnoff found himself in a peculiar position. Here he was, an officer in the Imperial Army, anxious to continue the fight but looked upon with suspicion by the new government. A journey to Vladivostok brought the solution to his problem. It was rumored that British and American authorities there would accept volunteers. After a 31-day journey by cattle truck across Siberia he got in touch with British agents who dispatched him across the China Coast to Singapore.

In Saigon the French offered Smirnoff a commission in the Foreign Legion but that seemed hardly what he wanted. Arriving at Singapore he discovered that the British Intelligence Service had forgotten why he had been sent. Instead they wanted to imprison him on a charge of communist affiliation. Fortunately the Russian consul at Vladivostok vouched for him.

After months of pushing and pulling Smirnoff reached London where the Royal Flying Corps finally decided to accept him as a private. On his second day in flying school the commanding officer

Working Hand-in-Glove

Behind the scenes in Precision Aircraft Radio Manufacture . . . One of a series, photograph by BR Photo

"CALLING D FOR DORIS . . . CALLING D FOR DORIS . . ." Somewhere up in the stratosphere, a flier's gloved hand flicks on a Bendix* Aircraft Radio and the voice of the squadron leader comes in clear and crisp, unblurred by the biting cold. The operating frequency is correct . . . set by means of a frequency standard which a girl's gloved hand tested here in the Bendix "cold box," where 40-below temperatures duplicate conditions of altitude flying.

Bendix Radio employees thus literally work hand-in-glove with our fliers . . . testing aircraft radio equipment for its ability to function not only in the bleak cold of the upper air, but in the blistering heat of the tropics . . . in desert dryness and jungle humidity . . . for its ability to stand up under combat strains and landing shock. Bendix engineers have devised more than a thousand such tests and inspections covering every stage of production, from single parts and sub-assemblies to the compact, finished radio.

Maintenance of the highest standards of quality and precision in manufacture, plus exhaustive pre-flight testing, assure dependable performance even under the most extreme conditions . . . have earned for Bendix Radio equipment the deserved confidence of our fliers in the armed forces, and the pilots of our commercial airlines.

THE INVISIBLE CREW — Bendix Aviation Corporation

*Trade Mark of Bendix Aviation Corporation

BENDIX RADIO

BENDIX RADIO DIVISION OF THE BENDIX AVIATION CORPORATION

BALTIMORE, MARYLAND NORTH HOLLYWOOD, CALIFORNIA

Since inception of Civil Air Patrol, RANGER transmitters and receivers have contributed to the splendid work of CAP by providing dependable two-way radio communication in scores of ships on active and training duty.

With a broad range of models available for small and large ships, RANGER has always endeavored to place CAP at the head of its delivery list—while still keeping on schedule with Army and Navy contracts.

Two-way RANGER Aircraft Radio

The Model 206 transmitter and Model 108-B receiver are an ideal combination. The transmitter is rated at 10.5 watts antenna output, and employs a RANGER designed vibrator type power supply using 6 or 12-volt ship's battery. (Dynamotor power supply available for 24-volt systems.) The receiver features an easily read scale covering the 195-410 kc range, two-way interphone circuit, and a spot frequency at 3105 kc, or other predetermined point, for interplane reception; dry battery power supply in separate cabinet.

OTHER MODELS AVAILABLE

For use where no storage battery is installed in ship, two other sizes of transmitters are available. The Model 203 is rated at 1.5 watts antenna output; batteries and transmitter are in the same cabinet. The Model 204 is rated at 4.5 watts antenna output; has separate dry battery power supply.

Get this manual FREE

Civil Air Patrol members are invited to secure this "Procedure Manual for Aircraft Radiotelephone Communication," for their training programs. It is available without cost, as a service to CAP by RANGER.

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promoted him to the rank of sergeant-major and he was allowed to try out a British pursuit plane. Smirnoff was about ready to go overseas with his British squadron when peace was declared.

By then a first lieutenant in the RFC, Smirnoff looked around but saw very little for a man of his experience to do. The RFC, which had just changed its name to the RAF (Royal Air Force), made the same observation and decided to demobilize him. Smirnoff, the ace of aces, found himself without a job. There was no choice but to take a job as an airplane mechanic at Croydon airdrome near London and be satisfied with a $20 weekly pay check.

In talking with various pilots, Smirnoff heard that a new Belgian air transport company was looking for pilots to fly commercial transports. With about 700 operational hours to his credit Smirnoff was a far more experienced man than anybody could hope to find after a war in which the average "life" of a pilot in operations was just below 30 minutes. So the company took him.

For one year Smirnoff piloted De Havillands, Spads de Commerce and Farman-Goliaths between Brussels, London, Amsterdam and Paris. But this soft spot was too good to last long. One night the company's entire fleet, which was nicely stored in a big hangar near Brussels (also used by the Germans for Zeppelins), was destroyed by fire. Our ace was out in the street once more.

This time Smirnoff was better prepared. He was known at all commercial airdromes and knew what was going on in the rapidly growing civil aviation. He was acquainted with some young energetic Dutchmen who were struggling with unruly British pilots in the newly-founded Royal Dutch Air Lines (KLM) and offered his services to them. He was accepted conditionally, then permanently when his experience proved invaluable.

Thus, after piling up some 2,000 flying hours in the war and flying every type of plane that could be found, Smirnoff started a career with the KLM which was interrupted only when the war in Asia called all able-bodied Hollanders to the colors. Smirnoff, meanwhile, became a naturalized Dutch citizen, inseparable from one of Holland's most intensely national undertakings—the Royal Dutch Air Lines. He was the first man to fly the regular mailplane from the Netherlands to the East Indies, in 1928. As commodore of all Netherlands civilian pilots he made the famous trip of 1933, carrying Christmas mail from Holland to Batavia in the record time of 100 hours.

Forty minutes after landing he started on his return flight—with New Year's mail for Holland—and 100 hrs., 30 min. later he arrived back in Amsterdam. Landing in thick fog and snow with visibility zero, Smirnoff set his plane down without a scratch. The stolid Netherlanders hoisted "Turc" (his KLM nickname, known from Karachi Moro to Krempangan, from Croydon to Alahabad) on their shoulders and carried him around the flying field in triumph.

The outbreak of the present war found Captain Smirnoff outside Holland, on his 77th trip from Amsterdam to Bandung and when the Pacific became an additional theater of war he was transporting troops and supplies at the rate of 200 flying hours monthly. By that time he had 24,000 hours of flying time to his credit and had covered about 3,400,000 miles of air distance. More than 25 years had passed since he first learned to handle the controls of a plane.

In the bleak hours of the early morning of March 2, 1942, Smirnoff started his last 1,500-mile journey to Australia with a full load of 12 passengers. He had made this same journey every day for the previous 10 days. At the last minute, as he was about to take off from Bandung airport, an official handed him a heavily sealed parcel containing valuables from the Java Bank. Hastily Smirnoff stowed the parcel away with his dispatch case in the cockpit. The packet contained $1,500,000 worth of diamonds.

Around daybreak, as he neared the Australian coast, Smirnoff saw smoke columns indicating an attack on Broome. He did not like the looks of this arrival port and turned his shiny Douglas airliner north, trying to dodge the Zero fighters who evidently had been and possibly still were at work. But three Japanese fighters sighted and attacked his plane and Captain Smirnoff was forced to land on the beach at Carnot Bay, an isolated locality 60 miles north of Broome. Despite six bullet wounds, in both arms and his right leg, and notwithstanding the fact that one engine had been set afire, Smirnoff landed his plane. One tire had burst as a result of machine-gun fire, and the plane ground looped so that it faced the sea, but there it rested without additional damage. The plane was machine-gunned again and again. The Japanese continued to play with this defenseless group of people until they had exhausted their ammunition. Sea water, meanwhile, extinguished the fire.

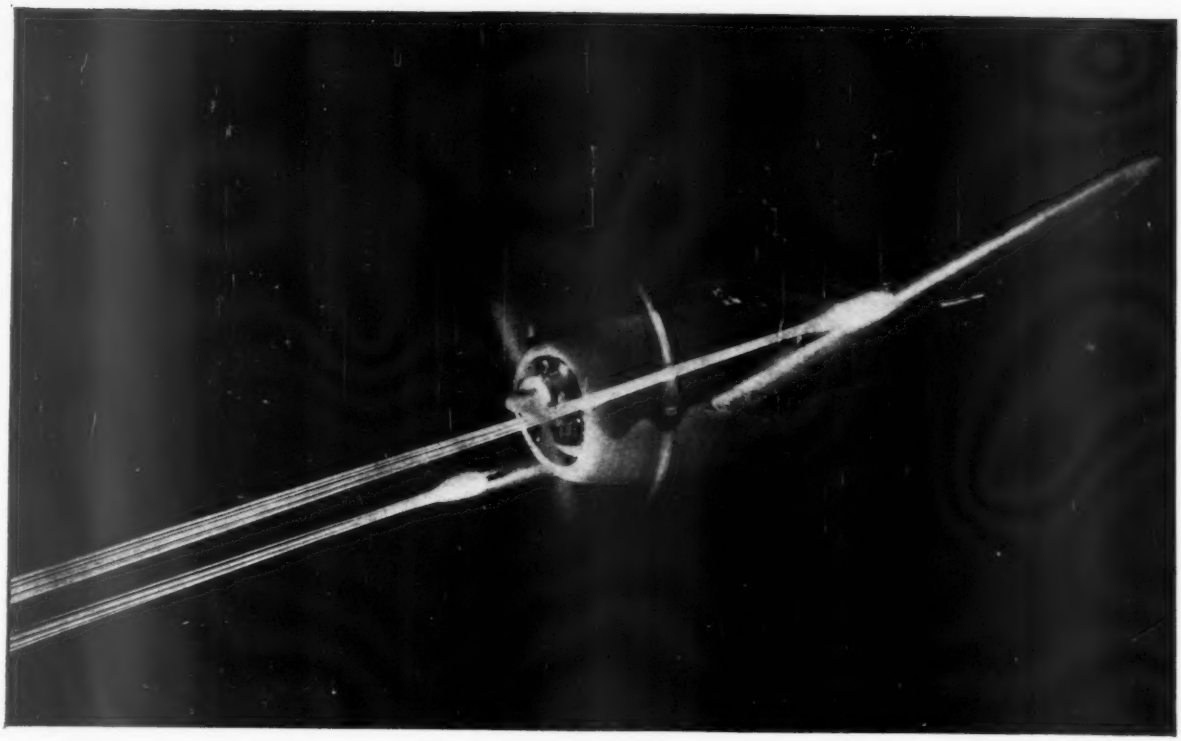
The next day the stranded airliner was bombed by a Japanese flying boat. Altogether four of the passengers, including a baby, lost their lives.

In the meantime a funeral service had been held in Sydney by KLM pilots who believed Smirnoff had been killed. His wife had officially been a widow for two days when an Australian pilot noticed the wreck and dropped food and water to the survivors on the beach.

After the Zeros had disappeared and the wounded had been attended to, Smirnoff decided to bury the parcel of diamonds for safekeeping. Several days later, when a rescue party reached the survivors, the wounded and exhausted captain was unable to locate the package and after frantic efforts the search was finally abandoned.

The sequel to this episode came on May 2, 1942. On that day a middle-aged, not too well-dressed man walked into an enlistment office in Perth, Australia, and after exchanging a few words with the recruiting officer took an ordinary sugar shaker out of his pocket. He inverted it on the desk and out cascaded

(*Continued on page* 108)



The Thunderbolt Strikes!

With its eight 50-calibre machine guns blazing, the Republic Thunderbolt deals out destruction—knocking out 993 enemy planes to 218 P-47's lost up to February, 1944! This high-flying fighter is every inch a world's heavyweight champion. To carry great loads at Thunderbolt speed, "U.S." tire engineers developed lighter, stronger U.S. Royal Airplane Tires. With the constant cooperation of the AAF, tires were built with bodies of rayon and with treads of natural and synthetic rubber. Test after test in the laboratory and in combat have proved that U.S. Royal Airplane Tires are champions, too!

The U.S. Royal Block tread used on Thunderbolt landing wheels protects against forward and lateral skids, insures positive braking. The U.S. Royal Channel tread for tail wheels combines minimum bounce with pneumatic tire cushioning.

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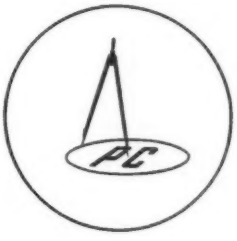
A field light is a relatively small part of an airport's equipment—but not small in importance.

Piston rings are relatively small, too. But not small in importance to aircraft engine manufacturers.



The world's finest piston rings are standard equipment for these world-famous aircraft engines—Allison • Wright • Packard-built Rolls-Royce • Franklin • Warner.

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(*Continued from page* 104)

a fortune in diamonds—the very ones Smirnoff had given up for lost. The man, Jack Palmer, told the astounded recruiting officer that he had found the diamonds in a water-soaked, broken parcel on the beach north of Broome and that he wanted to turn them over to the authorities. He then enlisted in the army.

But Palmer, a former beachcomber, was arrested by Australian police almost a year later and charged with keeping for himself $81,788 worth of the gems. He was tried in Melbourne on May 18, 1943, but the jury voted him not guilty, stating that the temptation was inordinately great. James Arthur Mulgrue, a shop assistant and former pearler of Broome, and Frank Archibald Robinson, a mechanic, accused of unlawfully receiving $7,256 worth of the jewels, were also acquitted.

An aboriginal woman found $40,000 worth of the diamonds in a tube hidden on the beach. A resident magistrate, cleaning his tool chest, found a matchbox which he was about to throw away when some absorbent cotton sticking out of one end attracted his attention He opened the box and found it to be full of diamonds. A Chinese was proved to have sold shirts and trousers to aboriginals, trading them for 10 or 15 diamonds apiece. Eventually about 85 percent of the diamonds were recovered.

Meanwhile Smirnoff recovered and reported back for duty. He flew more than 5,000 miles, from one side of Australia to the other, in order to give his evidence in this case before the Supreme Court of Western Australia.

Now the first lap of his next 24,000 hours is being filled. Guided by a sense that can no longer go wrong, his plane lands smoothly on operational bases in the Southwest Pacific.

Turc, with his fellow pilots of KLM and KNILM, is at war again. END

Inventors' Council

(*Continued from page* 55)

heat more effectively than anything now in use. It is now at Wright Field undergoing tests and will make its debut on fighting planes soon.

The Council sometimes wishes, however, it could have a brake for inventors, especially in certain fields. It would be nice, for example, to put a brake on propeller inventors. Almost daily someone appears with a device for a method for "doubling the efficiency" of our propeller. The first suggestions to come in merely proposed addition of another blade but the number of these has lessened. The engineers of the Council patiently explain that the present average efficiency of the airplane propeller is at least 75 per cent, and express polite doubts that anybody can double that to make a propeller 150 per cent efficient.

Perpetual motion proponents still call at the Council's office, so accessible on the first floor, third wing of the Commerce building. The latest was a man who would mount an electric motor in the nose of a plane to turn the propeller. On each wing he mounted a fan attached to a generator. Current from the generators is fed to the motor to turn the propeller. To start, power is taken from a battery. Everybody saw through that one at first glance but there was no discouraging the inventor. He wouldn't brush off. He came back with his Congressman and became a cause celebre around the Council. They still need brakes for perpetual motion dreamers.

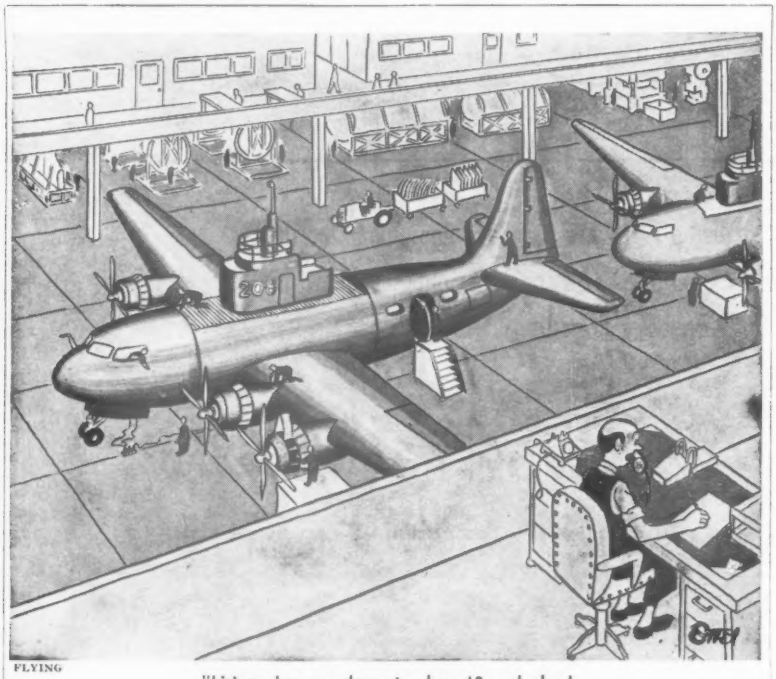
All the screwy ideas in aviation have, at one time or another, come into the office. There was the flying submarine, presented by the designer complete with a model and really good drawings. The letter indicated, however, that he should be working as a commercial artist rather than as an inventor.

The combination dirigible and airplane has been proposed as a quick means of winning the war. Some inventors put wings on dirigibles and others put helium in the wings and fuselage of the airplane. New ideas on fuel, especially on that old favorite, water, have filled several file cabinet drawers. The fellow who wanted to take water aloft, break it down into hydrogen and oxygen and run engines with it felt aggrieved that his idea was put under a cold shower.

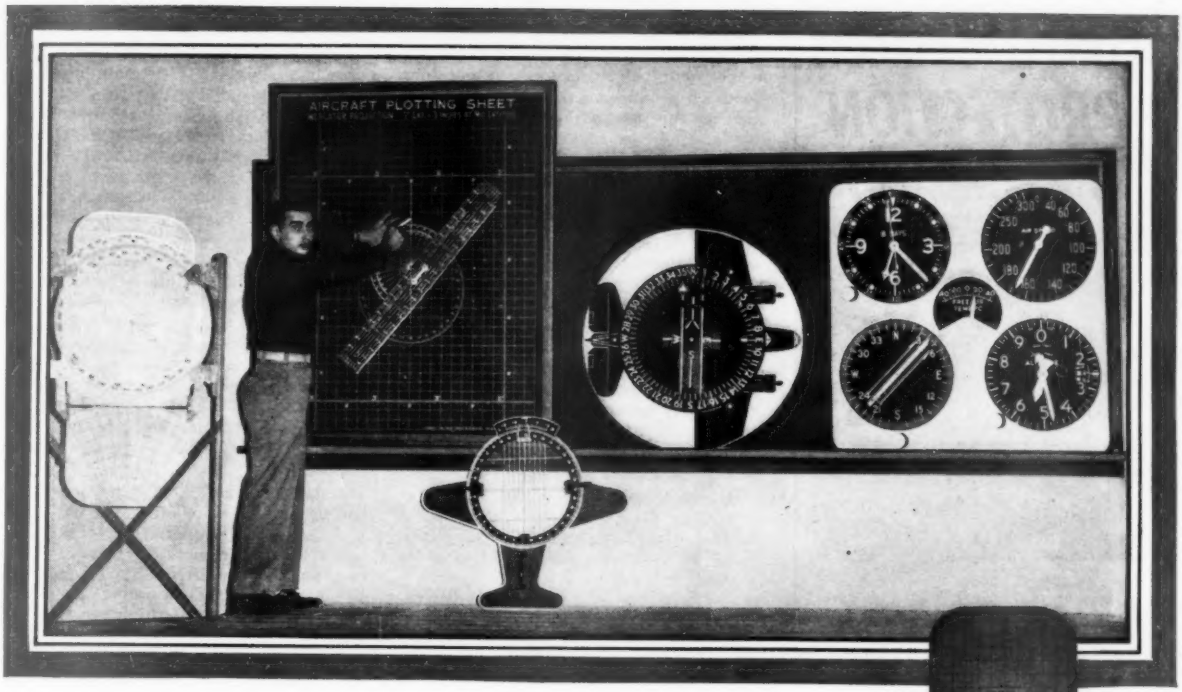
After all these years there still are some who propose man-powered machines. One even proposed an engine and propeller on each foot of a man a la Mercury. One persistent contributor sends in revisions of his plan periodically. His reasoning is simple. If one pair of wings will do so much, two, three, four of 40 pairs will do just so much more. The easiest way to attach these wings is in tandem, and his airship as of today is a huge affair with long rows of wings in tandem. Another has proposed that we build a huge scale model of a dragon fly, put it into a wind tunnel and really learn something about flying.

Veterans in aviation will be interested to know that the wobble plate motor is back in numbers. More than 100 such motors have come in under their inventors' arms. There have also been the usual schemes for getting an airplane up into the air quickly, the most vigorous one involving the use of three powerful springs working in connection with three guns. Together, springs and guns quickly get the airplane into its proper element. The little matter of forward motion was left to others by this particular inventor. He had his senator working for him for awhile until the Council convinced him against his will and saved the Senator's valuable time.

"The Case of the Spinning Tire" might be one of the literary works of the Council when they get around to writing their war journal. Scores of ideas for starting big airplane wheels spinning before they touch the ground have been handed the Council. They don't want any more. The idea is that it doesn't matter too much if the wheels do scream bloody murder every time they hit a concrete runway. Sure, they rub off a little rubber but even at that the tires will last almost the life of the plane. The Council knows we must conserve rubber but the amount of rubber wasted in this fashion is negligible and unimportant. What ruins tires are rocks and ruts. Let them squeak and let them



"Listen, Joe, go down to shop 18 and check that center section assembly jig, will you?"



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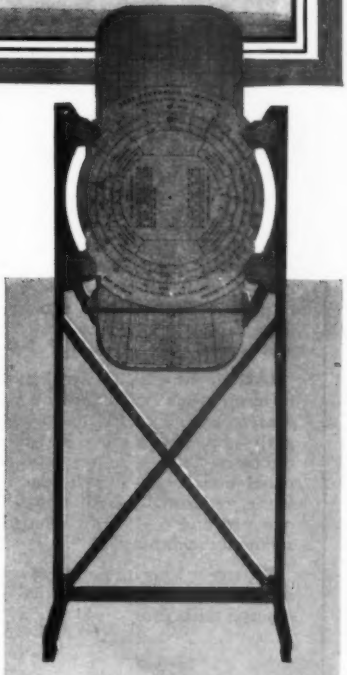
WEST
North Hollywood, Calif., 12021 Ventura Blvd.—Pan-American Navigation Service



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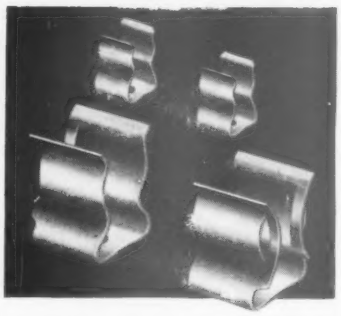

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FUSE CLIPS

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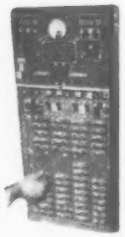
Exclusive Littelfuse design and forming effect *contact over largest possible area.* Results: Extra tight grip—maximum electrical conduction—less heat produced—panel board and switch temperatures reduced—loss of clip-temper prevented—spring qualities retained much longer.

Whatever your fuse clip requirements, Littelfuse will be glad to counsel with you.



Littelfuse equipment on Pan American Clipper. Courtesy of Pan American Airways System.

LITTELFUSE INC.

200 Ong Street, El Monte, Calif.
4757 Ravenswood Ave., Chicago 40, Ill.

alone, says the Council to the inventors.

Recently the Council heard the familiar plaint "Somebody stole my idea" in connection with the tire-spinning inventions. Goodrich produced a tire with collapsible cups on the side which would begin to spin as the cups caught the air and be turning at the moment the wheel hit the ground. Immediately after Goodrich's publicity men got their pictures in the paper, inventors began crying to the Council. Colonel Lent patiently pointed out that many inventions for this purpose had been recorded, some as far back as 1931. He also quoted Brig. Gen. Franklin O. Carroll, Chief, Engineering Division, Wright Field: "75 per cent of tire failures in service are due to hitting ruts and obstructions in the field and are not due to wear resulting from landings. In order to attain 50 per cent of the landing speed, the top part of the tire must be shielded."

Colonel Lent adds, "Nobody stole an idea. The idea is many years old, as shown by our little search in the patent office. We've had about 100 ideas along this line, but I don't think the Air Services will use any of them because the expense of moulding the extras on the tire is greater than is justified. The wheels are down too short a time to get the wheels spinning at 80 to 100 miles an hour."

Among the contributions in aeronautics valuable to the war effort has been a new interest in a low aspect airplane wing. This is still on the hush-hush list but responsible government agencies are working on it. Important new ideas in gas turbine power plants have been received and passed along to the military. There are even some hopeful signs in some serious thinking about "cycloidal propulsion"—in common language, side wheel paddles for airplanes—but so far these have not attained the dignity of a project.

Remote aiming of aircraft guns is well along, thanks to developments that have channeled through the Council.

Of the two principal duties of the Council's engineers, one is to seek out likely inventors and ask them to help in specific problems or developments. The other is to meet all and sundry and to investigate each new idea. When there is a suggestion for an invention, the Council turns to a man known to be interested or experienced in the field or a related field.

Milkweed is now important to pilots, especially those who fly over water. When the Japs took Java, the supply of kapok was cut off. It had long been a valuable material for stuffing life preservers and other flotation devices. In Chicago, Dr. Boris Berkman had been investigating the value of the long-rooted milkweed as a "crop" for combating soil erosion. He had found the floss of this plant to be water repellent and lighter than kapok. Now he is working on a million dollar appropriation to produce this material for the armed services, with $5,000,000 more proposed.

As sidelights, he has found the seed which the floss carries by air to be valuable for cattle feed; the pod is rich in latex for making rubber; the stalk fiber makes a fine quality of paper; and a little salt and pepper and some salad dressing, says Dr. Berkman, make the leaves pretty good eating as a salad.

The Army and Navy are now using a device that was developed in the Council. It is a method invented by C. E. McGavic of truing up airplane brake discs in the field, a valuable contribution to maintenance of large airplanes in actual service.

Classic story of the Council is that of the metallic land mine detector and it now has its sequel in another classic story. Wade Stiles, wealthy Floridian, was playing around in offshore waters hunting sunken treasure—some of which he found—when the thought struck him that his special electric detector might be valuable to the military. He brought it to Washington before Pearl Harbor and the Army engineers picked it up. We now have the best land mine detector in use by our Allies or our enemies. But—and this is the sequel—the Germans are now making non-metallic mines of plastic and wood. The Inventors' Council has been asked to produce a detector to meet the new problem. "I think we have it," says Colonel Lent.

A continuing problem, however is a quick and sure means of destroying land mines, and the "help wanted" sign is out on this job.

Aeronautics has produced a definite type of invention, which the Council calls the "bloodhound projectile." Its purpose is to pursue and destroy aircraft. Thus far most of the proposals involve the sound waves emitted by the airplane in flight and this furnishes an explanation of the shortcomings of many inventors.

"They are not grounded in the fundamental physics or mechanics on which their inventions are based. An airplane, for example, moves at about half the speed of sound and a projectile attracted to the spot from which the sound came would arrive there only to find the air plane far removed."

Most of the worthwhile inventions, as in all past wars, have come from civilians and not from professional soldiers or even from men in uniform. The Council has publicly urged leading engineers to send in any ideas for inventions they may have, pointing out that the idea of the submarine was suggested in 1620 and not brought to practical application until more than 200 years later. Veterans are urged to encourage young engineers and work out their plans with them. It is almost impossible to tell today all that we need because we would be telling the enemy what we lack but our engineers are attacking all of these problems most vigorously.

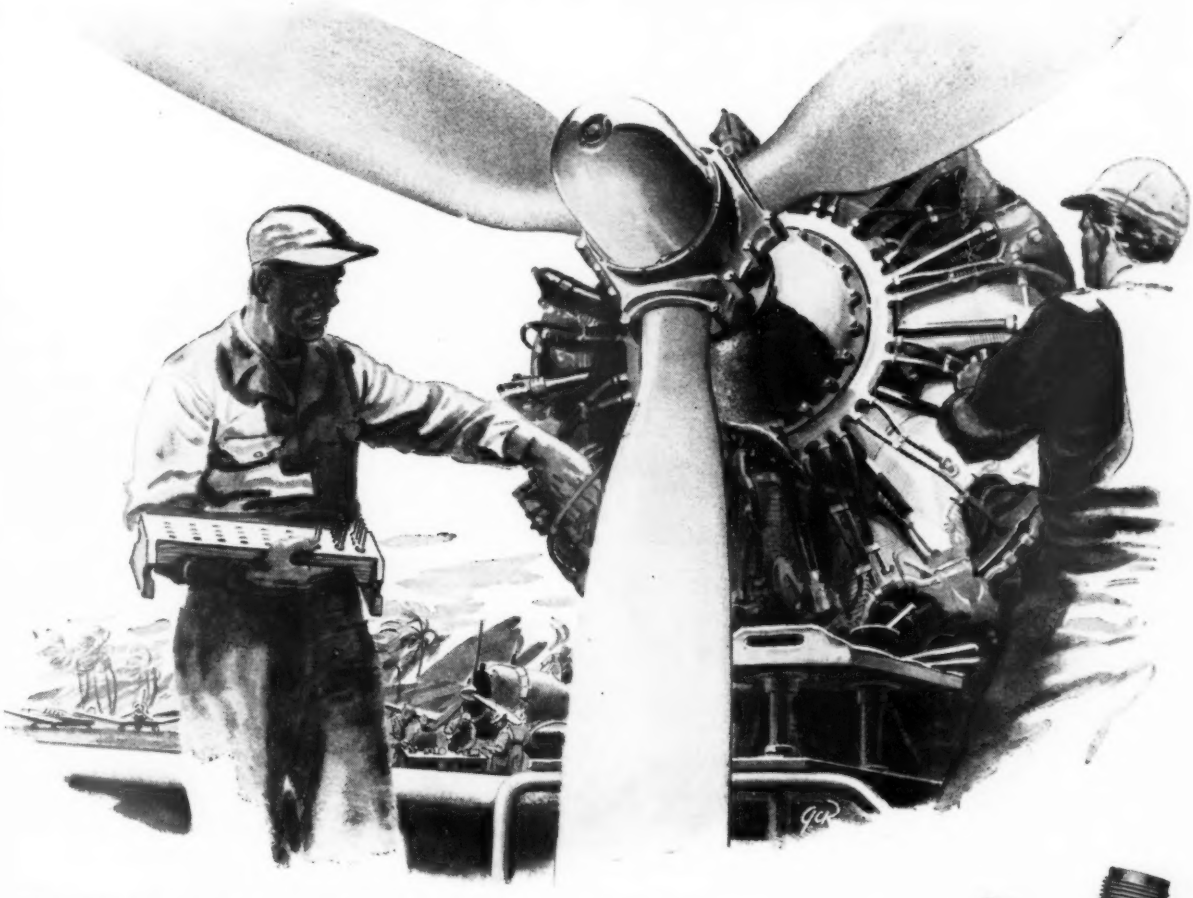
Colonel Lent keeps his mental fingers crossed. He says, "don't forget that a kid named James Watt got a very pregnant idea from watching his mother's kettle—so the story goes. You never can tell where some worthwhile idea will come from.

"Don't be surprised if something radically new and potent comes to light before this scrap is over." END

Dependable

CHAMPION SPARK PLUGS

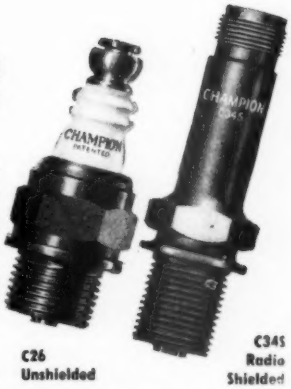
AVAILABLE FOR ALL ENGINES
IN BOTH RADIO SHIELDED AND UNSHIELDED TYPES



Champion Ceramic Aircraft Spark Plugs, like all Champions, have earned a reputation for making every engine a better performing, more dependable engine.

This is directly due to certain inherent characteristics that stem basically from the specially developed ceramic insulation and other exclusive and patented features around which all Champion Aircraft Spark Plugs are designed.

Proof of the outstanding performance and dependability of Champions in engines of every size and type is the fact that Champions were used during more than 95% of the million military training hours flown by Southwest Airways.



C26 Unshielded

C34S Radio Shielded

Champion Spark Plug Company • Toledo 1, Ohio • Windsor, Canada • Feltham, England

ONE MILLION HOURS CLOSER TO VICTORY

TWO LIBERATORS *manned by 22 U. S. Marines, on Feb. 4, 1944, became the first foreign aircraft to fly over the Jap fortress of Truk. For twenty minutes the two Liberators cruised through the ack-ack, photographing and mapping the long guarded secrets of this vaunted enemy base. This daring 2,000-mile reconnaissance mission paved the way for the great U. S. battleship-carrier task force that struck Truk so devastatingly 12 days later.*

One of our Boys helps *pry the lid off Truk*

ONE of the aerial photographers peering down at ships, dry docks, coastal guns and airdromes of Truk was young Marine Corporal Thomas J. Humphrey. Before enlisting in June, 1942, Tommy Humphrey was working at Thompson Products. His job was the inspection of valves and other aircraft parts—the same kind of Thompson precision parts that were in the Liberator which carried him safely, nearly 2,000 miles over enemy waters and through freak storms which put ice on the plane's wings as it crossed the equator.

We looked up Tom Humphrey's original letter of application for employment. Written in 1939 it starts out "*I am one of thousands of young men looking for honest employment and have tried every way possible to get established with a concern where one may advance as he grows more proficient.*"

Corporal Humphrey, once established with Thompson Products, is now with another concern—the U. S. Marine Corps—a *going* concern which will keep going until it reaches Tokyo.

And when that job is done, Tommy Humphrey and thousands of others like him will come back home, again hoping for "honest employment where one may advance as he grows more proficient."

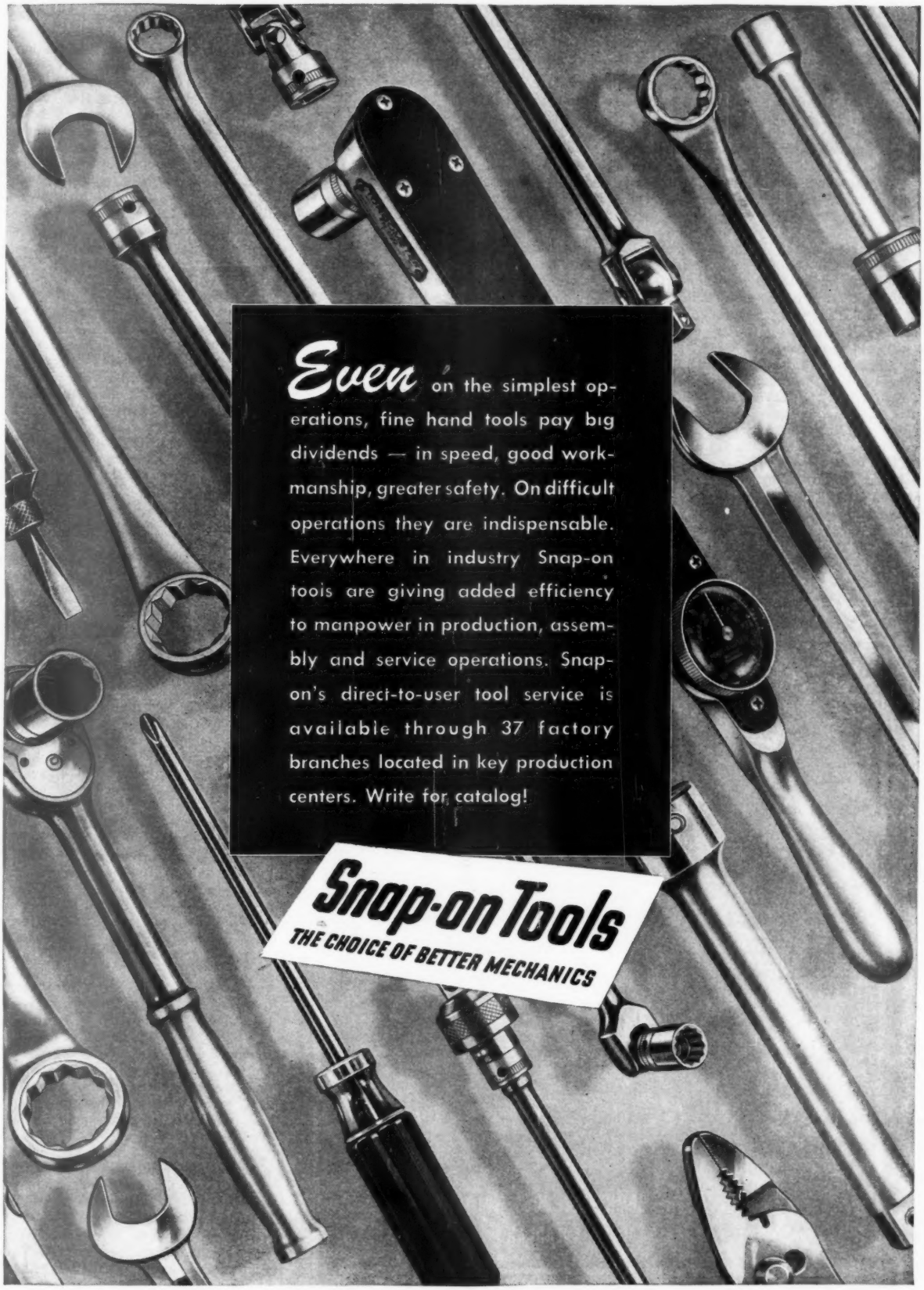
That's what he and his buddies are fighting for—let us at home make sure that the America they come back to is ready and free to give them this opportunity—an opportunity to work with full freedom for individual self-improvement and an even chance to progress and prosper.

Beating production schedules on vital parts for Planes, Tanks, Submarines, PT Boats, Torpedoes, Jeeps, Half-Tracks, Tractors, and Trucks

Thompson Products, Inc.

THOMPSON AIRCRAFT PRODUCTS CO.

MANUFACTURERS OF AUTOMOTIVE AND AIRCRAFT PARTS, GENERAL OFFICES: CLEVELAND. PLANTS IN OHIO, MICHIGAN, CALIFORNIA, AND ONTARIO, CANADA


Even on the simplest operations, fine hand tools pay big dividends — in speed, good workmanship, greater safety. On difficult operations they are indispensable. Everywhere in industry Snap-on tools are giving added efficiency to manpower in production, assembly and service operations. Snap-on's direct-to-user tool service is available through 37 factory branches located in key production centers. Write for catalog!
Snap-on Tools
THE CHOICE OF BETTER MECHANICS

SNAP-ON TOOLS CORPORATION, 8024-G 28th Avenue, Kenosha, Wisconsin

Modification Center

(*Continued from page 54*)

wall and was large enough to house the noses of two planes from the wings forward.

The planes were run in facing each other, separated by a wooden partition and covered with a wooden, sloping roof. A wall of canvas, which laced around the plane fuselages, extended from the roof's edge to the ground.

Gas furnaces identical with those used in homes were installed on the ground near the tail of each plane. Heat from these was piped through a window in the fuselage. This heat would drift through the whole plane and eventually into the lean-to, creating a fairly comfortable working condition.

Modification to make possible a later installation of the British bombsight was a bit tougher than revamping a ship's nose to accommodate cameras. It necessitated changing the plane's wiring system and completely remodeling the original supports which had been built in to house the American bombsight. In the absence of blueprints, the men clamped a British bombsight in place and built, piece by piece, the necessary supports to hold it firmly.

The job of modifying measuring instruments to read in British units as well as American was comparatively simple. Small placards were printed with the British equivalents of American units and glued to the instrument panel alongside each instrument involved. On a fuel gauge reading in American units of measure the placard would read "100 gals Am = 83.27 Imperial gals."

Changing the radio installations to suit British equipment necessitated removing most of the radio wiring plugs and supplanting them with plugs of a different size to fit British jacks.

The installation of racks to hold flares and drift-recorders was easy. Loops of strip steel were mounted on the sides of the fuselage. Below these, the men installed cups to house the nose of each flare. Chutes, resembling rectangular boxes with a reel of string at the top and a release catch for opening a small trapdoor in the bottom of the plane, were installed below the racks.

Work on six of the planes was finished in less than 30 days. Army pilots arrived and flew them to unknown destinations.

March blew in like a lion that year. With it came 17 more *Flying Fortresses*. This lot needed the same changes as on the first batch of planes destined for Britain, plus such additional changes as the installation of more radio equipment, Acrotorque windshield wipers, application of British camouflage (for coastal patrol work) special antennae, installation of black-out curtains, British recognition lights and Very pistols.

The new planes also needed fuel tank "sloshing." When aromatic fuel comes in contact with rubber bullet-proofing, the inner lining of the tanks swells up. United was instructed to slosh the inside of the tanks with a substance which would have no ill effects on either the fuel or rubber. An agitating jig was constructed of welded metal strips and a heating device was set up to "bake" the liquid.

While the 17 *Fortresses* were still in the works, 16 more arrived from the factory. By this time, United had seen the handwriting on the wall and already made plans for increasing its personnel and augmenting its Cheyenne hangar space.

In March the Materiel Command authorized construction of additional hangar space and requested that United submit designs for the job, estimated to cost $800,000. Subsequently, plans were submitted for more hangars which raised the estimate to nearly $2,000,000.

United was instructed to submit a complete list of all machinery, parts and other appliances needed to Wright Field within 48 hours. According to Long, catalogues, descriptive literature and other data on machinery were spread on the floors of United's Cheyenne engineering offices and the men worked from mid-morning until dawn the following day compiling a list of equipment. It was delivered to Wright Field before the deadline.

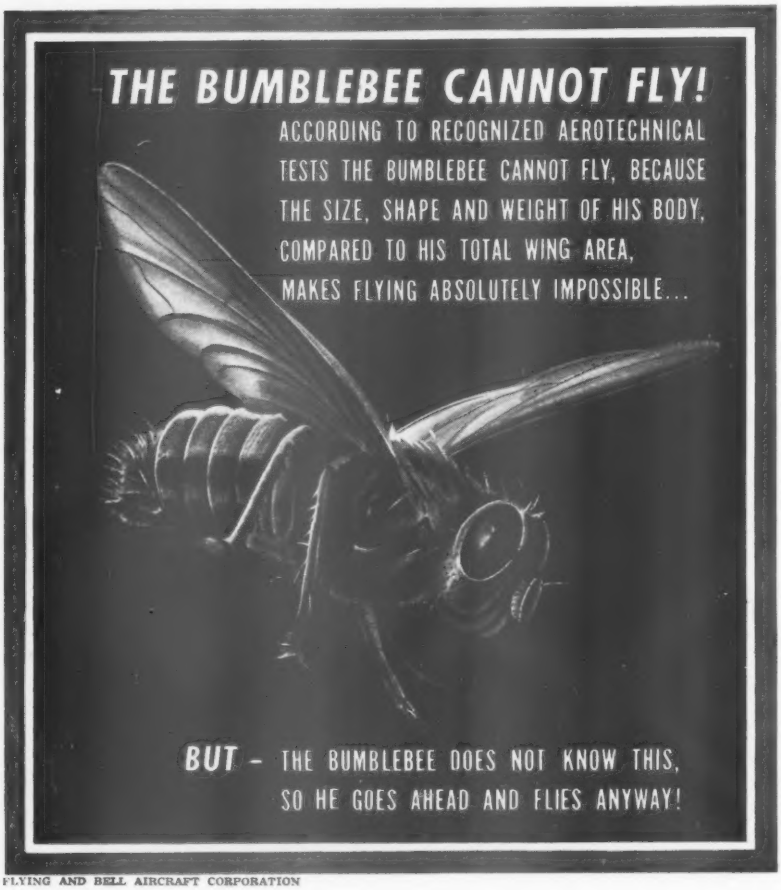
Army engineers broke ground for two new hangars in May, 1942. Each hangar was to be 400 feet long, 160 feet wide, 55 feet in over-all height and each equipped with a two-story lean-to, 40 feet deep and 400 feet long. Included in the building project was an L-shaped employee cafeteria occupying 3,750 square feet and capable of seating 180 employees at a time, and an airplane parking area of 1,000,000 square feet. While waiting for construction to be completed, two outdoor production lines, illuminated at night by large flood lights, were set up. The first plane moved into the new hangars early in September. In August, 1943, ground was broken for another building to include a hangar, warehouse and garage, all under one roof. The new structure was to be 160 feet deep, 400 feet long, 55 feet high and equipped with a two-story lean-to 400 feet long and 80 feet deep.

While these improvements were being made, B-17E's and F's flowed through United's "temporary" set-up in a steady and ever-increasing stream. From April, 1942, to September of the same year, the output of modified planes averaged 30 per month.

October began to show benefits of the new hangar space, with production that month having stepped up to a monthly average of 60, which was continued until January, 1943.

During the first month of 1943, 111 planes rolled down the runways. Production was so increased that, for the first

(*Continued on page 118*)

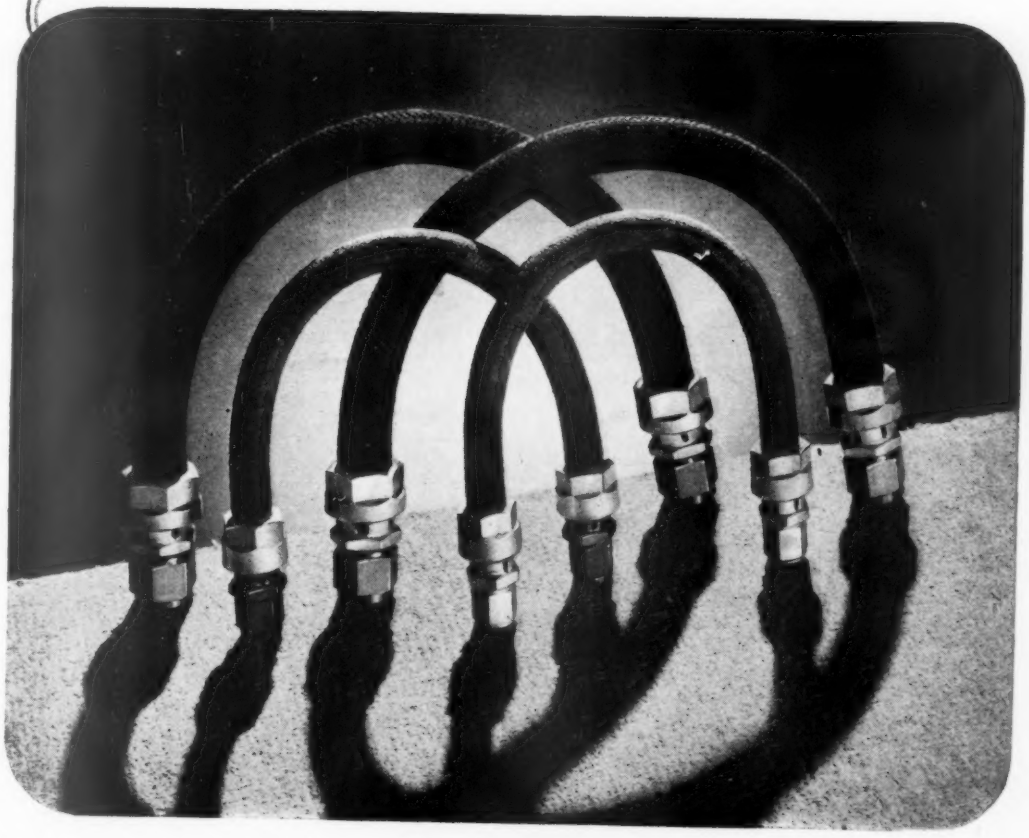

THE BUMBLEBEE CANNOT FLY!
ACCORDING TO RECOGNIZED AEROTECHNICAL TESTS THE BUMBLEBEE CANNOT FLY, BECAUSE THE SIZE, SHAPE AND WEIGHT OF HIS BODY, COMPARED TO HIS TOTAL WING AREA, MAKES FLYING ABSOLUTELY IMPOSSIBLE...
BUT - THE BUMBLEBEE DOES NOT KNOW THIS, SO HE GOES AHEAD AND FLIES ANYWAY!

FLYING AND BELL AIRCRAFT CORPORATION

Life lines OF MACHINES AND MEN!

This is a good picture of four strands of FLEXIBLE HOSE—but no picture at all of their dramatic part in modern warfare. It would take moving pictures to tell *that* story! You'd see water, fuel and oil rushing through them at the height of battle . . . in planes, tanks, ships and combat cars in every sphere of combat.

Truly the wartime function of simple flexible hosing is equalled only by its peacetime potentialities. As the world's largest manufacturers of this product, the four plants of The Weatherhead Company have played a prominent part in the nation's war effort—and are prepared to assume the same role in Peace.



Look Ahead with **Weatherhead**

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*

ONE MILLION HOURS

200 ROUND TRIPS TO THE MOON

114 Years Packed into 3

SOUTHWEST AIRWAYS' 1,000,000th pilot training hour has just been recorded... in a phase of aviation with which production figures rarely are associated.

Yet, it truly *is* a record, an *essential production* record—for what good would 100,000 planes a year have been *without the pilots to fly them?*

Helping to build these world's finest and best-trained Air Forces has been a "Southwest" assignment for 3 years. At Thunderbird, and our 3 other fully-equipped flight training centers, cadets are steered safely through Primary, Basic, and Advanced training—grounded in knowledge, plus the confidence to use it.

Alone, we have schooled more than 15,000 men... from 29 countries in every part of the world... for the Air Forces of the United States, China, Great Britain and their Allies.

SOUTHWEST'S OTHER FACILITIES, too, are devoted exclusively to military assignments. Planes of our Cargo Division daily rush hundreds of pounds of vital, highest-priority Army freight and mail to West Coast bases... part of the far-flung Air Transport Command system. Here at Phoenix... military aircraft and engines pass in a never-ending stream along the production lines of our Overhaul Depot.

It is a lasting tribute to the 2000 patriotic men and women who together *are* "Southwest," that they could have done so much, so quickly, so well. Today, to their many previous production achievements, we proudly add another—114 years... 1,000,000 hours of military pilot training... in just 36 short months.

One million hours closer to victory!

SOUTHWEST AIRWAYS

Phoenix, Arizona

Contractors to **FLYING TRAINING COMMAND**, at Thunderbird Field and Thunderbird II, for Army Air Forces primary training.

AIR TRANSPORT COMMAND, carrying cargo and mail on military area airlines of the Cargo Division.

UNITED STATES GOVERNMENT, at Sky Harbor, for C. A. A. —W. T. S. Link instrument and cross-country training.

UNITED KINGDOM GOVERNMENT, at Falcon Field, for R. A. F. and A. A. F. primary, basic and advanced training.

AIR SERVICE COMMAND, for military aircraft and engine repair at the Overhaul Division.

(*Continued from page* 114)

six months of that year, an average of six planes daily left Cheyenne on their way to combat areas. This average was increased for the last six months of 1943.

The reason for modifying so many planes should be explained. Airplane production today is on an assembly-line basis. Reports for desired changes frequently are received from combat zones and plane manufacturers can't revamp assembly lines and still keep up with production schedules. Furthermore, planes being built today are destined to go to all parts of the globe. Some need winterizing, some equatorial equipment. Mass production is a highly standardized procedure. Consequently, it saves time to have modification centers make last-minute changes according to special combat or geographical needs.

Many of the earlier modifications made at Cheyenne have long since been adopted and are being installed at the airplane factories. Parts and blueprints made by United have been sent to all companies manufacturing the *Forts*.

Planes sent to Cheyenne after June, 1942, needed different and frequently more complicated changes than did previous arrivals. Some of the major modifications included cheek-gun installations on either side of the plane's nose, construction of a monocoque gun mount for .50-caliber machine guns, installation of "chin" gun turrets, and revamping of entire tail turret assemblies.

Not all the orders for modification came from the AAF. Occasionally, employees make valuable suggestions. The monocoque gun mount was the result of the engineering ingenuity of W. W. Erickson, a member of United's supervisory staff at Cheyenne.

Another suggestion, which since has proved a boon to aerial gunners, was made by members of the "Jack the Ripper" bomber crew returned from combat. They complained that use of their intercommunicating microphones had necessitated the removal of one hand from the gun controls in order to push the switch button on the mike. Sometimes this happened during critical moments of an air battle.

United engineers rebuilt the mike control switch, placing it on the machine-gun grip. This device now is used on most airplane machine guns. All the gunner has to do to switch on his mike is to slip his thumb to the side of the gun-grip.

Production at Cheyenne steadily increased; the personnel roster grew longer.

In March, 1942, United had 625 employees at work in its maintenance base. These employees were, at that time, devoting 25 per cent of their time to modification.

By the middle of April, 1942, the company started hiring additional personnel. Some of United's crack traffic salesmen were transferred from key cities to Cheyenne to help put over the job. They "beat the bushes," recruiting cowpunchers, tractor operators, farmers, high school and college graduates, garage mechanics, stenographers, beauticians, teachers and clerks from nearby towns and cities. By July, between 400 and 500 skilled and semi-skilled people were doing nothing but modification work. By the time a norm was attained in the spring of 1943, the company had over 1,600 modification workers.

Of these new employees, more than 50 per cent were women. They were put to work as sheet-metal fabricators, drill and punch press operators, riveters, and at other mechanical operations. Their average age is about 26 years while the average age of men at the center is considerably higher, and a goodly proportion of the workers have husbands, sons or daughters in the armed services, some of them flying the *Fortresses* modified at Cheyenne. END

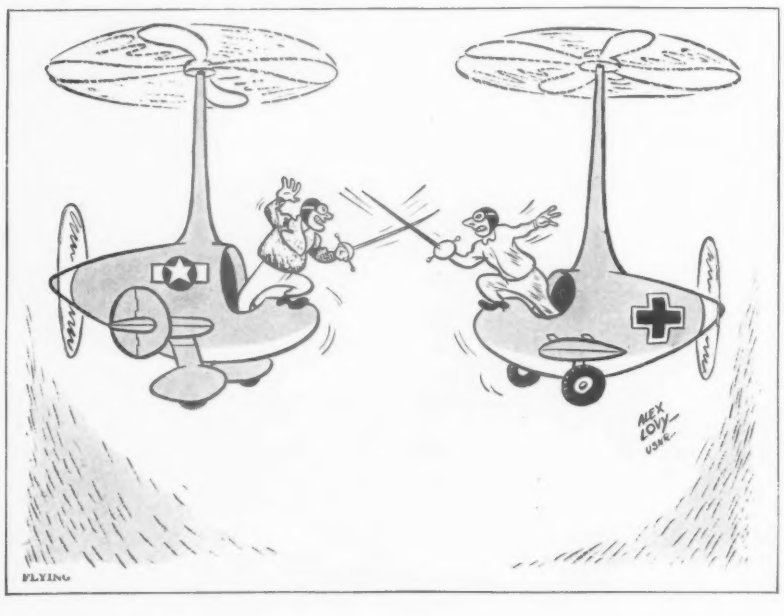
Foggia—Airpower Symbol

(*Continued from page* 31)

important to our offensive strategy as a base from which Allied bombers might range over Europe in a greatly widened circle. To continue the advance from the toe of Italy it was necessary to nail Foggia down. To get on with winning the war, it was important that we possess it. A Foggia victory would be not only a tactical triumph but a strategic success of immeasurable import. Foggia is in close striking range of the Balkans and southern Germany, 465 miles from Vienna, 500 miles from Munich, 580 miles from the Ploesti oil fields.

And to airmen, the most significant fact of all may be that when General Montgomery and his U. S. Allies finished their conferences and mounted an offensive to take Foggia, they built the entire program around a lightning air attack. Far from supplementing or working in co-ordination with ground troops, planes were to lead the advance.

Montgomery has words for it:



"If you examine the conduct of my campaigns, you'll find we never fought a land battle until the air battle was won. . It is the first great principle of modern warfare." Thus he paraphrases the U. S. War Department dictum that "the gaining of air superiority is the first requirement for the success of any major land operation."

From the June, 1940, campaign against the Italians in Libya, and from the desert campaign in 1941-42 against the Luftwaffe, the efficacy of co-equality between air and land power was established in contrast with the enemy's use of air power simply as support for, and responsible to, the land forces.

In Tunisia, this principle was further worked out. Brig. Gen. Laurence S. Kuter, then American deputy commander under Air Marshal Coningham, reported in May, 1943, that "it is intended that the lessons learned and the successful methods developed in air-ground co-operation shall be translated into broad American air effort as quickly as possible. . It is the pattern of the future, the way in which air power in collaboration with the armies in the field will beat the enemy and win the war."

The import of these words became clear by the end of July. Lieut. Gen. Carl A. Spaatz, joined by the U. S. 9th Air Force in the Middle East under Maj. Gen. Lewis Brereton, cleared the Sicilian skies of enemy planes, blotted out enemy airfields and destroyed communication lines. The Northwest African Air Force initiated the invasion of Sicily, July 9.

War Department records show that the

(*Continued on page* 122)

and the message DOES get through!

One of the first pieces of equipment landed on a newly established beachhead is the Army's high powered, mobile SCR-299. In half-track or truck, this Hallicrafters-built GIANT OF MILITARY RADIO is a vital link in the chain of communications. Subject to the bombing and shelling of the enemy, the sturdy SCR-299 can really take it—and dishes it out by getting the message through to direct the fire of land, sea and air forces.

BUY MORE BONDS! hallicrafters RADIO

THE HALLICRAFTERS COMPANY, MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

Photo Courtesy the Signal Corps

This is a bomber-riding radio man. With high-precision, Belmont-made equipment, he is tuned in on the greatest drama of our times . . . a drama in which he is one of the audience and one of the principal characters too.

It is a drama filled with periods of nerve-racking silence . . . the chilling sound-effects of machine-gun fire . . . moments of high exhilaration, deep anxiety, and painful suspense . . . *a drama in which many may pay with their lives if but one muffs a line or misses a cue.*

The responsibility of this radio man is great indeed. But willingly he accepts it, concentrates on it, and meets it with all his resourcefulness and skill. And as producers of much of the equipment he uses, Belmont accepts its own responsibility in this same spirit. Belmont Radio Corporation, 5947 West Dickens Avenue, Chicago 39, Illinois.

ARMY E NAVY

Belmont Radio

RADAR ★ TELEVISION ★ FM ★ ELECTRONICS

BATTLE-READY...

IN the misty dawn along an English street roll the day's newly arrived Thunderbolts. Tear off the "wrappings," condition them for flight—and they're *battle-ready!* For changes and improvements to meet the Army's latest fighting techniques were built into them as they rolled along the Republic assembly line.

All such alterations in design and equipment are hard to make. The re-design or re-location of even a small element in the airplane may sometimes affect the design of a much larger section. And to build such changes into the plane *without halting production* poses the severest problem of all.

Republic anticipated this critical problem. It was determined that no change in battle tactics would ever find the Thunderbolt unready. Republic accordingly created a new kind of production system in which high speed was combined with extreme flexibility in assembly methods. When something new is to be added to the Thunderbolt, or a strategic change is to be made, the production line doesn't *stop* for the changes. It simply *absorbs* them! The line keeps *moving!*

There is nothing easy about maintaining a production system which is at once fast *and* flexible. It only *sounds* easy. But it *does* deliver Thunderbolts in quantity, and on time, to all theaters of this war, equipped and *battle-ready* to meet the latest tactical requirements. *Republic Aviation Corporation, Farmingdale, Long Island, New York, and Evansville, Indiana.*

WRITE THAT BOY TODAY ... V-MAIL!

Thunderbolt

Republic *firsts* in war point to *firsts* in peace

REPUBLIC AVIATION
CORPORATION
Specialists in High-speed, High-altitude Aircraft

(*Continued from page* 118)

Allies maintained such marked air superiority in the first four days of the invasion that grounded planes were destroyed, the air was free of enemy fighters, airdromes were pulverized and the enemy was forced to move 170 fighters and bombers to the Italian mainland.

In the first four weeks of July, U. S. planes flew 12,583 sorties, dropped 12,460 tons of bombs, destroyed 342 enemy planes and probably destroyed 54 others, probably sank three enemy ships and damaged 10 more, with a loss of 190 U. S. planes.

By the end of the third week in July, the Allies held complete and overwhelming air superiority not only over Sicily, but also over central and southern Italy.

And then—August 25—and Foggia.

It wasn't the first time that the Italian city had been hit. Two weeks before the invasion of Italy it took a pasting in one of the heaviest bombing raids of the Mediterranean war. But that raid was only part of the invasion time-table; the attack of August 25 was for keeps.

Hours before, the *Lightning* pilots along with *Flying Fortress* and *Liberator* crews had assembled in briefing rooms at scattered airdromes of the Northwest African and 9th Air Forces. The orders had come in by teletype:

"Target for today—Foggia airdromes and marshalling yards.

If the mission itself was a masterpiece of precision timing, the planning was super-precision—on a hair-trigger schedule. After Foggia had been selected, it might seem logical that weeks of preparation would follow. But the decision to strike came only at the last minute. Things began to happen. Planes, already fueled and bombed up and previously alerted for an undesignated target, stood ready for action.

Divisional commands immediately began to work out painfully intricate details—amount of fighter support, routes, times, aiming points, number of bombers. Complete information from the intelligence files concerning enemy installations and disposition of strength was studied.

The airmen were briefed, took their posts. Take-off times had been co-ordinated to the second among the airfields. Exactly at the pre-determined moment the planes held their rendezvous, swung into formation and headed for Foggia.

The great base was struck in a triple attack.

First, 133 specially-equipped *Lightning* fighters, marking their first flight of that distance at such a low level, hedgehopped across Italy and sped in to strafe the airports, virtually knocking out the enemy's air strength before he knew what was up. The enemy was so surprised and the planes flew so low that the Germans first resorted to heaving rocks and firing pistols.

The toll was 140 enemy planes: 60 destroyed on the ground, 80 damaged. They were mostly Ju-88's, but at least one Ju-52 transport was destroyed as it was attempting to take off. Six *Lightnings* were downed and six more reported missing.

The *Lightnings* had prepared the way for the *Fortresses* by rendering the enemy air strength impotent. As quickly as they came they sped away, missing by seconds the first bombs from the *Forts*.

The big four-engined bombers, 138 strong, escorted by 36 more *Lightnings*, attacked the airdromes from high altitude, dropping 242 tons of high-explosive and fragmentation bombs. Of the 60 to 100 enemy aircraft which had managed to get aloft, 34 were destroyed, 19 probably destroyed and 13 damaged by *Fortresses* and two by *Lightnings*.

The way then was clear for 28 *Liberators* to race in for an attack on the marshalling yards with 64 tons of bombs. That the *Lightnings* and *Fortresses* had done their job well was attested by the fact that the *Liberators* encountered only 25 enemy planes, of which three were destroyed and three more probably destroyed.

A rain of blockbusters from unmolested British *Wellingtons* finished off the attack —and Foggia.

It never recovered. A few weeks later, on the afternoon of September 27, Montgomery's troops were able to enter the city almost without opposition. His armored columns raced the last 25 miles through Marshal Albert Kesselring's defenses to take over the Foggia base and all 12 satellite airdromes. Kesselring's rear guard was barely ousted before engineering units arrived to patch the runways and to get the shops and hangars into shape. Large stocks of bombs, airplane parts and locomotives were captured plus some rolling stock. Air power had not only prepared the way for Monty's advance, but covered it all the way.

Thus the pattern which the Allies had developed in a small way in the western desert and had pounded into sound principles in Tunisia and Sicily and in the invasion of Italy, was coaxed toward perfection at Foggia.

Foggia made history, and history has been known to repeat itself in this war on a progressively enlarged scale. END

Ground Pilot

(*Continued from page* 43)

times a bridesmaid but never a bride." She's itching to fly them.

She sees nothing glamorous or heroic about her job, for "nothing exciting ever happens."

"It's my job," she explains, "to keep anything from happening, to make sure that every plane and every part of it is right before it goes aloft for the first time. Sure, sometimes I find a prop that doesn't go from low pitch to high pitch just right, a prop that doesn't 'track' right, a throttle that will jam, brakes that stick, a ship that doesn't taxi just right.

"It's my job to keep the pilot from finding those things after he gets into the air—and into a jam—by finding them first. And I'm particularly eager to find those things first, because some day I'll be hoping that someone else finds them before *I* get into the air."

Her pet peeve is the reluctance of people generally to accept a woman either as a pilot or a pre-flight inspector; and one of her toughest ordeals came shortly after she was employed at Curtiss-Wright.

Ordered to take a *Helldiver* out on taxi tests at Port Columbus, she climbed into a suit of white coveralls and drew a helmet around her hair, then climbed into the high cockpit.

Instantly the word that a woman was to test a *Helldiver* ran through the plant, work at many spots was stopped and the workers crowded outdoors. Thousands of pairs of jealously-critical eyes were turned on her.

"Huh, a woman," she heard deprecating loungers say, in frank disapproval of permitting a woman to taxi test the plane. For aircraft workers are proud of their handiwork, eager to see that their planes get only into the proper hands.

Self-consciously, she taxied out on the field. Aware of those thousands of faces ringing the field she put the plane through a series of taxi tests to determine if the landing gear would hold, if the ship would hold its path.

The disapproval turned to approval as she taxied back, and she hasn't had any trouble since; and E. L. Bradley, superintendent of flight inspection at the plant, declared:

"I wish I had a half dozen more like her."

Miss Heberding has quite an impressive record as a pilot, including 10 months as an instructor on the Civil Air Patrol's anti-submarine patrol duty.

A student at Ohio State University, she learned to fly back in 1939, unbeknown to her parents—until they read about her flying exploits in the newspapers. She had scrimped on her allowance, using her savings to pay for the flying time.

In July, 1941, she won the Carl Friedlander trophy as the highest scoring woman pilot in the Intercollegiate Flying Club meet at Middletown, O., rolling up 91 points against 57 for her nearest competitor; and in November, 1941, she was the only girl pilot entered in the Ohio State Flying Club meet at Columbus—but she won from 25 male competitors.

After graduation, Miss Heberding worked as a dairy bacteriologist for six months. But the job was too tame. She quit, then found a job as a flying instructor in the Civilian Pilot Training Program, one of Ohio's first women instructors.

When the Civil Air Patrol was organized, she joined, and when an Ohio unit was formed to set up and operate an anti-submarine patrol base on the Florida east coast, she promptly quit instructing, joined the unit as the only girl

(*Continued on page* 126)

BLACK WIDOW *is*
the name and the general idea

The Black Widow spider is a formidable creature. It lurks in the dark . . . attacks unseen . . . cuts down its prey with poison 15 times stronger than rattlesnake venom

THE NAME "Black Widow" is a natural for the Army's new warplane, the P-61 *night fighter*.

The "Black Widow" airplane is the first designed-for-the-purpose night fighter. Its job is to attack the enemy by night. To protect air-strips and beachheads . . . to guard cities . . . to cover unloading operations. To intrude behind enemy lines and harass trains and airfields, destroy *matériel*.

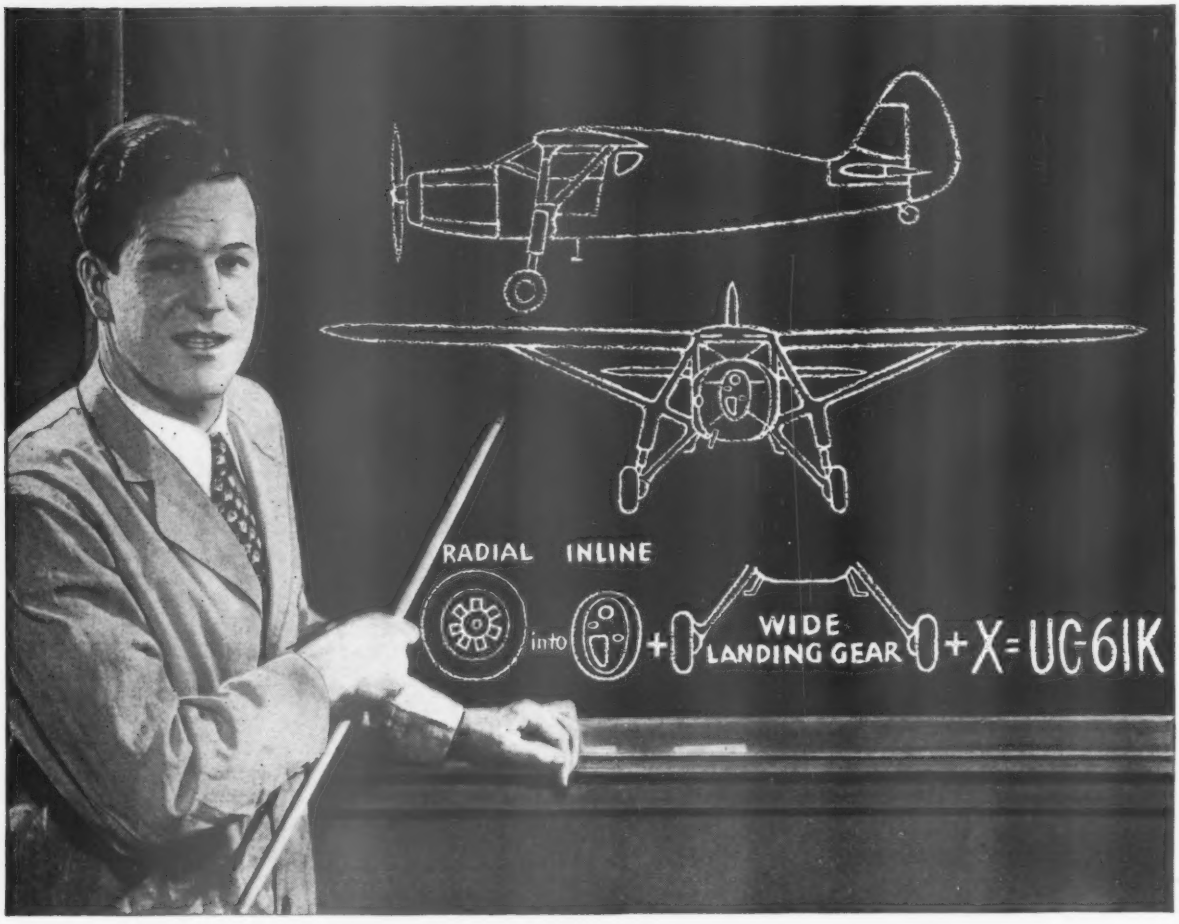
The Northrop "Black Widow" is the largest, most powerful pursuit plane ever built. It has unusual speed. It can also loaf, almost hover as it hides in the night sky. Its firepower is devastating. It can take off swiftly and land slowly in the dark.

In cooperation with the Army Air Forces, the Northrop group designed the "Black Widow". You'll hear more from it . . . the deadly P-61.

NORTHROP AIRCRAFT, INC.
NORTHROP FIELD, HAWTHORNE, CALIFORNIA
MEMBER AIRCRAFT WAR PRODUCTION COUNCIL, INC.

NORTHROP
Designers and Builders of the
P-61 'Black Widow' NIGHT FIGHTER

POINTERS ON PLANES . . . . . *No. 6 of a Series*



Formula for "Forwarder"

The famous Fairchild "Forwarder", designed in 1932, has been constantly revised and improved . . . and is now called the UC-61K.

Ranked before the war among the most popular four place planes—and renowned now, as always, for its stability, it is performing a vital function in many theatres of war.

The engine section has been completely changed, with the 200 hp. Ranger inverted inline replacing the 165 hp. radial. The new "K" model has a longer, more streamlined nose, which makes it look larger and, in combination with a high wing design, affords better visibility both in the air and on the ground.

The use of wide landing gear, placed well forward, and the aid of wing flaps, makes possible short landings and take offs in small, rough fields.

These and many other improvements, such as ball bearings in all control joints which reduce wear, increase maneuverability, and add to the life of the plane, contribute to the growing popularity of the UC-61K.

It may be used, for example, in advance reconnaissance of enemy gun positions during invasions. And as a utility cargo carrier where medical supplies, ammunition, or parts must be rushed to the front lines. It speeds pilots and high-ranking officials to points where they are most needed.

In the "Forwarder" our armed forces have a plane which, since it first came from the drawing boards, has always been ahead of the times, the embodiment of the Fairchild "touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

Fairchild Aircraft *Division of Fairchild Engine & Airplane Corporation, Hagerstown, Maryland....Burlington, North Carolina*

Finish the Fight with War Bonds

These outstanding schools use Boeing PT-17 Kaydets as standard equipment:

Alabama Institute of Aeronautics, Inc.
Tuscaloosa, Ala.

Cal-Aero Academy, Ontario, Calif.

Darr-Aero-Tech, Inc., Albany, Ga.

Eagle Field, Dos Palos, Calif.

Georgia Air Service, Inc., Bennettsville, S. C.

Georgia Air Service, Inc., Jackson, Tenn.

Graham Aviation School, Americus, Ga.

Greenville Aviation School, Ocala, Fla.

Hancock College of Aeronautics
Santa Maria, Calif.

Hawthorne School of Aeronautics
Orangeburg, S. C.

Lodwick Aviation Military Academy
Avon Park, Fla.

Lodwick School of Aeronautics
Lakeland, Fla.

Mira Loma Flight Academy
Oxnard, Calif.

Morton Air Academy, Blythe, Calif.

Rankin Aeronautical Academy, Tulare, Calif.

Raymond-Richardson Aviation Company
Douglas, Ga.

Riddle Aeronautical Institute
(Carlstrom Field) Arcadia, Fla.

Riddle Aeronautical Institute
(Dorr Field) Arcadia, Fla.

Southern Aviation School
Camden, S. C.

Southern Aviation Training School, Inc.
Decatur, Ala.

Southwest Airways, Inc. (Thunderbird I, Thunderbird II and Falcon)
Phoenix, Ariz.

Tuskegee Flying Training School
Tuskegee, Ala.

"They ought to get a citation . . ."

"If anybody in this war deserves recognition, it's the civilian instructors and mechanics at the flying schools."

More than one Army Air Force veteran with a chest full of decorations has said that and meant it. For Army fliers know that the training of the world's greatest flight personnel would never have been possible without the skill and devotion those "forgotten men" of the war effort have given to their task.

On every sky-front where U. S. Army Air Force bombers and pursuit ships strike the enemy, there are airmen who sprouted their wings in Boeing Kaydet training planes, under the instruction of civilian primary flying schools.

The list of such schools is an "honor roll of the air."

MORE THAN 10,000 PT-17 KAYDET PRIMARY TRAINERS HAVE BEEN BUILT AT THE BOEING WICHITA PLANT **BOEING**

(*Continued from page* 122)

pilot at this Florida CAP base.

And an ambitious adventure it was! The personnel of 75 included about 30 pilots and observers, an adventuresome crew. It included many businessmen, professional men and others who eagerly abandoned their lucrative peacetime businesses for flying duty. Among the pilots was Congressman John M. Vorys, of Columbus, O., who, as a Naval pilot in World War I, flew an anti-submarine patrol and thus knew a lot of tricks of the trade. Others included a prominent Ohio contractor, a print shop proprietor, a couple of plumbers, a radio and refrigeration equipment salesman and the proprietor of a big Cleveland beauty shop.

The unit took over an old weed-grown abandoned flying field. It's runways were short. It had no buildings for operations and living quarters. It had no equipment and was a desolate place. But that didn't deter this adventurous crew.

All pitched in, using whatever skill they possessed. One crew mowed the runways, patched up the holes. Scouts found some abandoned buildings which had been a CCC camp. The crew, directed by the contractor, tore them down, moved them to the base and re-erected them for living quarters and operations headquarters. And a pretty amateurish job it was —for there were big gaps in the roof and walls that let in plenty of Florida rain or sunshine. But the crew made the best of it, merely moving their beds to the dry places when it rained.

Dolly, who held a master sergeant's rating, was made mess sergeant, an honor conferred on her because she was a woman and women are supposed to know how to get supplies and cook them. She succeeded fairly well.

And then came Dolly's heartbreak. The CAP declined to let her fly in the hazardous sea patrol duty, assigning her instead as an instructor for lightplane pilots who didn't have the necessary horsepower ratings to fly the Stinsons, Wacos, Cessnas and Fairchilds used in the patrols.

And that used to get her goat, too—for the male pilots assigned to her used to look her over, grunt and then say:

"Huh! A fee-male pilot to check us out! Nothing doing."

But they quickly got over their prejudices and let her teach them the tricks of flying the heavier and faster airplanes needed for the patrol.

Miss Heberding smarted under the insult of not being permitted to fly the same dangerous patrols as the men pilots whom she had checked out—but she got some adventure, too, for she served as operations officer of the unit for most of the 10 months she was at the Florida east coast base.

Pilots in the unit sighted some submarines, helped drive them off as they were about to attack merchant vessels. Several pilots were killed in accidents out over the ocean.

Although a skilled bacteriologist, Miss Heberding can't see anything in the future for herself by flying. She already is planning to open a small airport and flying school of her own after the war is over.

"For," she explains, "there's going to be a lot of flying business. A lot of people are going to want to learn to fly—and they probably won't any longer be prejudiced against women flyers." END

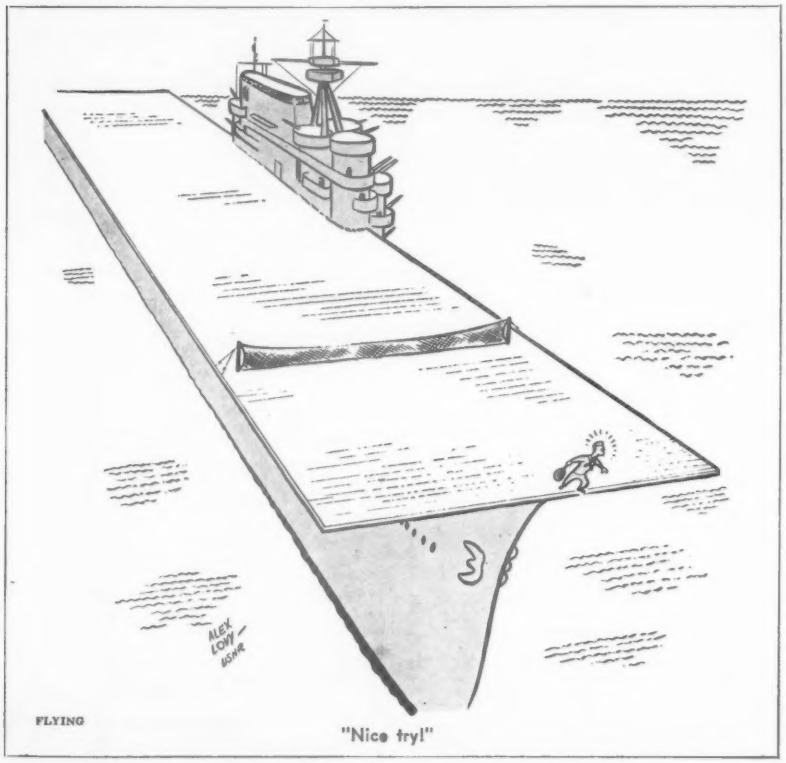
AAF Shangri-La

(*Continued from page* 33)

Ariz. from AAF redistribution stations located on the east and west coasts. (The AAF Redistribution Center is a new command which has recently taken over the administrative operation of the rest centers along with other functions pertaining to returnees from overseas.)

Under a second priority are men still recuperating from prolonged hospitalization. And under a third category are training and administrative personnel stationed in this country, who are overworked and badly in need of a rest. Men in these two categories are selected by the commander of their tactical unit or air base upon recommendation of the base surgeon.

As the men arrive at Lake Lure they are directed to their respective quarters. The enlisted men are housed in Rocky Broad Inn, the officers in Lake Lure Inn. Two to five men are assigned to a room. At present, there are accommodations at Lake Lure for about 110 enlisted men and 80 officers.



"Nice try!"

Each room is large, cheerful-looking, well-lighted and tastefully furnished. Olive-drab G. I.-ish foot-lockers are set amidst starched curtains, bedspreads of sundry hues and maid service.

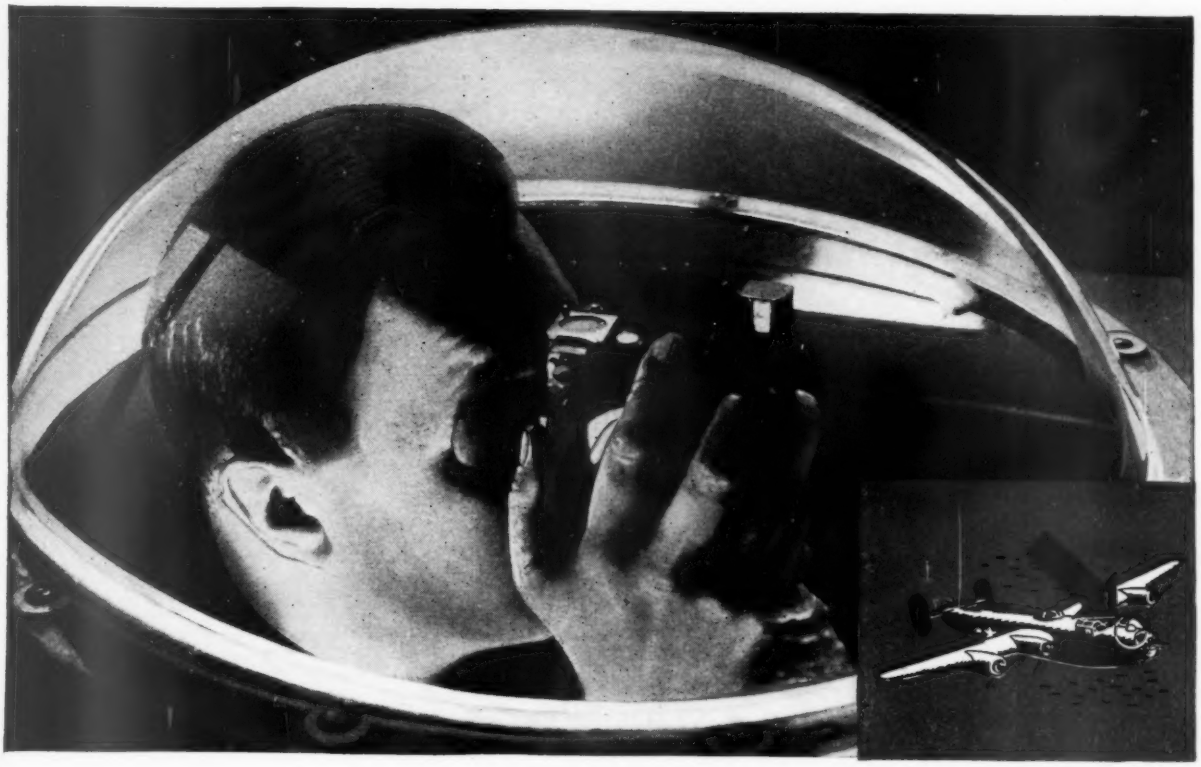
After lunch on the day of their arrival, the enlisted men at one hour and the officers at another assemble on the volley ball courts for the only "must" formation of their entire stay. Lieut. Col. Dudley B. Cocke, the commanding officer, discourses briefly on the do's and don't's of the rest center. It is mostly do as you please—especially as concerns uniform, participation in scheduled camp programs, curfew, etc. The only requirement is that each guest must personally sign the register each day between the hours of 6 a.m. and noon.

Lieutenant Colonel Cocke, who is in charge of the rest camp, is a veteran of the Mexican border warfare in 1916 and served as an aerial observer in the first World War. An active sportsman and outdoorsman, he was selected by the Third Air Force to head the rest center at Lake Lure. He has a detachment of about 40 enlisted men to administer. These men live in barracks and are detailed as medical assistants, in charge of quarters, orderlies, and as cooks and waiters in the two messes.

The enlisted men and officers eat in dining rooms of their respective inns. Meals are planned on regular Army garrison rations. The schedule of servings is breakfast from 7:30 to 8:30 a.m.; lunch, noon to

(*Continued on page* 130)

Navigators sight accurately through Plexiglas astrodomes



Over the target with precision . . . home to a distant base . . . navigators guide America's bombers on their far-ranging flights

* * *

THEY sight their octants through curved PLEXIGLAS sections called astrodomes. These are precision optical parts, every one meeting critical sighting specifications—yet Rohm & Haas has made them by the tens of thousands, using a special vacuum forming process developed in our plant before the war.

In astrodomes, as in many other aircraft applications, PLEXIGLAS offers superior optical properties . . . retains its transparency despite extremes of weather...increases safety by its high impact strength . . . conserves precious pounds by its light weight.

YOUR POST-WAR PLANE

Remember that PLEXIGLAS has *demonstrated* its durability...the permanence of its optical properties... its all-round advantages for aircraft applications...by 8 years of active flying service under all weather conditions.

Be sure your post-war plane is equipped with enclosures and parts made of "Aviation's Standard Transparent Plastic."

Only Rohm & Haas makes **PLEXIGLAS.**

PLEXIGLAS is the trade-mark, Reg. U.S. Pat. Office, for the acrylic resin thermoplastic sheets, rods and molding powders manufactured by Rohm & Haas Company.

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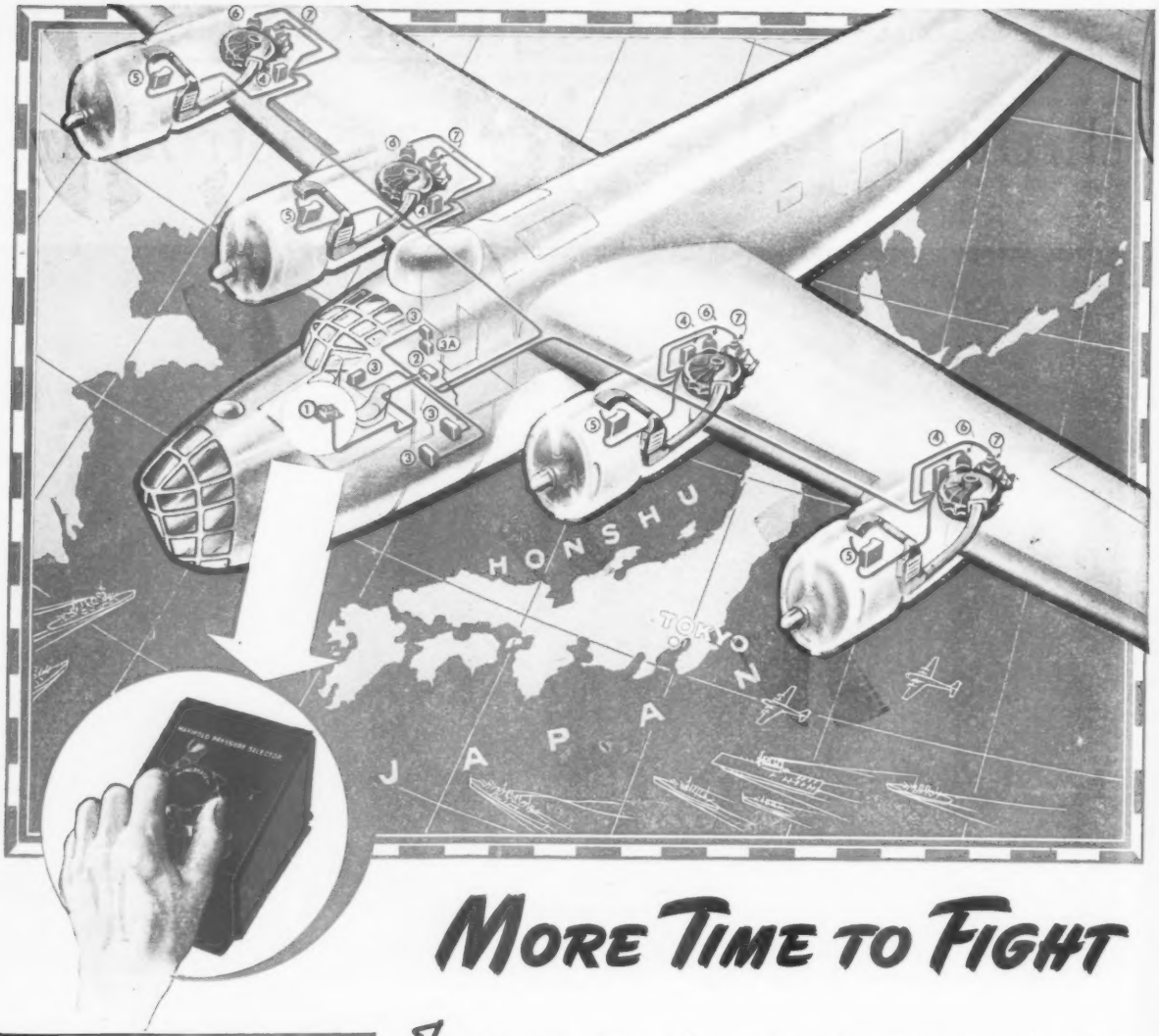


MORE TIME TO FIGHT

THE ELECTRONIC TURBO SUPERCHARGER CONTROL SYSTEM

1. *Manifold Pressure Selector*
2. *Main Turbo Control Junction Box*
3. *Turbo Control Amplifier*

3a *Spare Amplifier*

4. *Nacelle Turbo Control Junction Box*
5. *Induction System Pressuretrol*
6. *Turbo Supercharger Governor*
7. *Turbo Waste Gate Motor*

The Electronic Control System for turbo-superchargers is another Honeywell contribution to safer and more efficient bomber operation.

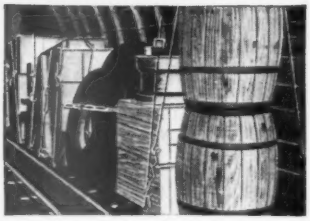
Engineered from the ground up by Honeywell, this system provides completely automatic control of manifold pressures and accurately governed turbo speeds. All four engines are controlled by the setting of one knob.

It gives Fortress and Liberator pilots more time to fight — more time to handle their ships — without worrying about manifold pressures and turbo speeds.

When victory is won, the same engineering ability that has contributed so much to wartime flying, will be ready to help with peacetime aeronautical problems. . . . Minneapolis-Honeywell Regulator Company, 2948 Fourth Avenue South, Minneapolis 8, Minnesota.

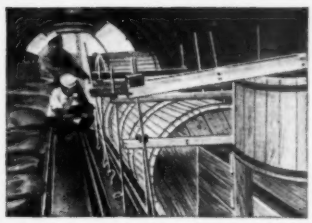
ELECTRONIC CONTROL SYSTEMS
for the AERONAUTICAL INDUSTRY

MINNEAPOLIS
Honeywell
CONTROL SYSTEMS



Evans Skyloader rope hooks and tighteners in service on a transport airplane. Note the mixed load and how securely the cargo is tied down.

Full load on a recent assignment. Bulky lashings and weighty knots are eliminated. Notice the even tie-ring pattern in the Evans Skyfloor.



Load is securely held with beams and tie-rods only. Passageway is kept clear and the cargo is readily accessible for speedy, efficient off-loading.

BUY MORE WAR BONDS

victory bound . . . box cars of the sky

Over the trackless wastes, the impassable jungles and the "bad lands" of the world go sky-borne cargoes, consisting of guns and the supplies of war today—and tomorrow, the goods of peaceful commerce.

Designed to simplify and systematize the new job of stowing air cargo, the Evans Skyloader method brings safety, speed and lightness to air shipments.

Evans Skyloader method offers: 40 to 50 per cent saving in the tie-down time of on- and off-loading; safety in flight for personnel, cargo and plane; and a very important reduction in the weight of lashings and the use of costly rope.

Other Evans Sky Products are also used extensively by the Air Forces on assignments of such importance that their nature cannot be disclosed at this time.

* * *

Vision to Anticipate the Needs of Tomorrow
Creates New Industries Today

C. L. Evans
PRESIDENT

EVANS PRODUCTS COMPANY
DETROIT

Evans War Products: Machine Gun Mounts • Tank and Automotive Heating and Ventilating Equipment • Evanair Water Heaters • Aircraft Engine Mounts • Airplane Landing Gear Beams • Battery Separators • Prefabricated Houses • Plywood • Skyloader • Utility Loader • Auto-Loader • Auto-Railer • Auto-Stop • Stampings • Evanair Domestic Heating Equipment

(*Continued from page* 126)

1 p.m.; dinner, 6 to 7:30 p.m.. Officers are charged $1.50 per day for food. Those going on fishing trips and wishing early breakfast may make arrangements with the mess officer the night before.

Base surgeon at Lake Lure is Capt. Howard E. Lancaster, who interviews each guest shortly after his arrival. On the basis of this and subsequent interviews the length of each man's stay is determined. A general medical practitioner for 20 years, Captain Lancaster owned and operated his own hospital in South Texas before coming into the Army.

Captain Lancaster finds his work at the Rest Center of absorbing interest, he says. He is especially gratified by the extent to which the "guests"—he studiously avoids using the word "patients"—are responding to their stay at Lake Lure. The men invariably gain weight and there is a marked change in their nervous reactions.

Chief credit for keeping the guests at Lake Lure occupied, entertained and in general good spirits goes to Bob Berlinger of St. Louis, Mo., Red Cross program director, and his staff of four girl assistants —Barbara Thrasher, Bakersfield, Calif.; Emilie Bruce, Norfolk, Va.; Mary Ann Mather, Lewistown, Mont.; and Jane Owen, Johnstown, Pa.

This group has devised so varied and extensive a recreational program that some phase of it is bound to appeal to each guest. A sample weekly program consists of a dance, movies, a "beach-screech" or "sing-binge" (informal group singing on the beach or in the golf course club house), a hike to Chimney Rock, a bicycle tour, a ping-pong tournament in the recreation room, and a carnival! For the carnival and the dance, partners are imported from a near-by girls' camp or neighboring towns.

Outdoor sports figure prominently in the recreational program. A veritable sportsman's paradise, the rest center has facilities for badminton, golf, canoeing, swimming (in season), baseball, archery, volley ball, tennis, and fishing. The Red Cross provides most of the athletic equipment. Competitive games are occasionally held between officers and enlisted men.

For quieter moods there is the camp library, its shelves stacked high with reading matter. Blueprinted for installation in the near future is a hobby and crafts shop where men who have a bent for carving, wood-working, clay modeling, etc., may work without interruption.

Participation in all these programs is encouraged but not required. "Do what you want when you want" is the theme.

A case in point is the enlisted man who spent his 10 days at Lake Lure sitting in a rocking chair in front of Rocky Broad Inn. All day and every day he rocked back and forth in the sun. Since he did not even read, the Red Cross staff became a little concerned about him. However, upon leaving he told Bob Berlinger that he had never had such a wonderful time in his life and that he felt "like a new man."

But such a case of recreation via a rocking chair is very rare indeed. At least 98 per cent of the guests participate in one or more phases of the recreational program.

After 10, 20 or even 30 days at the rest center, the men are returned to their bases and squadrons.

An increasing volume of laudatory letters is received by the Red Cross office attesting to the benefits derived from the camp. These letters are a revealing sidelight on the rest center's role. By effectively counteracting the effects of flying fatigue and by enhancing the combat efficiency of hundreds of Air Forces fighting men, it is contributing indirectly to the success of vital air missions and thus to ultimate victory. END

Report from Washington

(*Continued from page* 49)

also, these days, be forgiven if he swung back at some of the ground-bound critics who are saying, for the *nth* time, that aviation ain't what we'd hoped it would be as a factor in winning the war. He doesn't swing back. He just calls 'em as he sees 'em—without ballyhoo or big words. We got a quote from him the other day, and he's done it again:

"There are planes on almost every mission making a one-way trip. We have been getting great results from what is, statistically, a very economical expenditure of lives and equipment—but we don't get them free. The price of victory is what it always was, the lives of brave men. The men in the planes that don't come back are the ones who buy it for us and the ones who pay for it.

"Our missions [over Germany] are by no means merely 'preliminaries' to invasion. They *are* invasion. No one who has ever watched one of these great expeditions start will doubt it. The imagination can hardly grasp that skyful of planes, 20 miles across the front, 100 miles deep; formation after formation of our heavy bombers, under the swarming cover of our fighter escort.

"We are invading—and not at some remote beachhead. We are hitting the enemy where he lives. He knows that if he cannot stop us he is licked.

"Here is the crux of our air strategy, and here we have been able to face the enemy squarely with a desperate dilemma. The only way he can fight back against these air attacks is by putting up strong forces of fighter planes. He has no fighter planes to spare. He knows that when we come ashore in the west he is going to need these planes desperately. Oughtn't he to save them? He can't save them.

"Our bomber missions are headed right for the real source of all his air power, the plane factories, the ball-bearing plants, the vital installations. Without those he will be driven from the air in a week. He must put his fighters up and try to exchange them for enough of our bombers to cushion, though he cannot avert, the stunning blow.

"He now is in the fix in which he had the Royal Air Force during the Battle of Britain, but with a difference deadly to him. The German air force then had this same opportunity, but they were not ready for it. Hitler missed the boat because his bombers were too small, too few and, being unarmored and almost unarmed, too nearly helpless when attacked.

"Surely here is one of the great ironies of history. The men who planned this war, the men who thought themselves masters of the air, who believed in air power and were going to show the world how to use it, find that the wheel is come full circle.

"They thought right; but it is on them, on their airdromes, their factories and their cities that the proof is falling and will continue to fall until they can fight no longer.

"This is the meaning of the air war we are waging in every theater."

* * *

It is estimated that 22,500 man-hours are required to build the average U.S. bomber, and to put 1,000 four-engined bombers over Berlin from British bases, while requiring from 7,000 to 12,000 men in the air, takes at least 50,000 more men and women on the ground . . In January, 1942, American Export had 40 persons working in the field; today there are 1,800. .

* * *

Chickens are thriving in Brazil—thanks to air transport, according to Luiz do Rego Cavalcanti de Albuquerque of that country's agriculture department, who recently visited Washington. Some 35,000 chicks and small turkeys have been flown to farmers in the bulge of land that juts into the Atlantic toward Arica, where heretofore no poultry has been raised. Feed for the chicks also is flown in. They are being raised to assure good food for U.S. and other workers in the bulge region. . .

* * *

Conversation between two elderly officers overheard in the halls of the Navy Building: "I tell you, sir, I didn't vote for the admiral's idea because he was a classmate of mine at Annapolis, I voted for it because I thought he was right!"

* * *

Marc Thompson, formerly the architect for the Eleventh Naval District at San Diego and noted as a planner of Marine air bases, now is working out of Washington on a tour of the nation for the Building Design Unit of the CAA's Airport Service. His work is part of the overall CAA post-war airport planning now underway. . .

(*Continued on page* 134)

Dependable Overhaul Service for More Than Sixteen Years

Spartan Aero Repair, located in the heart of the nation, has behind it a continuous, successful operating experience of more than sixteen years. As a division of the Spartan Aircraft Company, an established name in aviation manufacturing since 1928, Spartan Aero Repair has unlimited resources and superior equipment.

This 100% C.A.A. approved repair station offers complete one-stop service to private owners. Machines of the latest designs enable S.A.R.'s staff of skilled mechanics to overhaul practically any make of engine, airplane, propeller, instrument, or radio.

Previously under contract to the army air forces, our entire facilities now are available to the needs of private owners. You can depend on Spartan to do any job efficiently, expertly, and at a reasonable cost. Write Dept. F-74 today.

• (Above) Engine Overhaul Department.

• (Below) Exterior Engine Test House —one of the most modern in the country.

• (Below) One of the Test Recording Offices in Engine Test House.

SPARTAN AERO REPAIR

Division of SPARTAN AIRCRAFT COMPANY

TULSA, OKLA. Established 1928

You have doubtless seen this and other pictures of aerial cameras in newspapers, magazines and in many advertisements. But do you know who developed the aerial camera — and produces, by the thousands, these vital instruments of war and peace?

It is the company founded by Sherman M. Fairchild, who developed the prototype of the modern aerial camera during the last war.

From aerial reconnaisance photographs taken with Fairchild cameras at altitudes up to *seven miles,* our Army and Navy glean vital information about the enemy. They determine, accurately, the position and caliber of guns, the location of radio installations, the count of enemy troops, naval vessels, etc., the nature and depth of submerged offshore obstacles, and other data essential to successful combat. In addition, they speedily prepare from aerial photographs accurate maps necessary for offensive action on land, at sea and in the air.

For all of these purposes, Fairchild makes these extremely accurate, unique cameras. A few of them are illustrated at the right. They are the cameras used to make the aerial pictures you see everywhere . . . truly the *aristocrats* among precision cameras.

A few of the modern Fairchild cameras, developed in cooperation with U. S. Army Air Forces and the Bureau of Aeronautics of the U. S. Navy.

Fairchild CAMERA AND INSTRUMENT CORPORATION

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THE STORY OF AERIAL PHOTOGRAPHY IS THE STORY OF FAIRCHILD CAMERAS

★ NUMBER 7 IN A SERIES, TRACING FIFTEEN YEARS OF KELLETT ROTARY WING PROGRESS ★

A Kellett in operation-tests with a State Guard Unit, during pre-war maneuvers.

Pioneer . . . Blazing Air Trails

PIONEERING is an American tradition. Every step in America's advance has been made because pioneer spirits first endured hardships to mark new paths—trails that encouraged others to take up the journey.

The scene pictured above is just one of the blaze-marks in the fifteen year trail marked by rotary wing pioneers. The aircraft flying close to tree tops was an early model, direct-control Kellett, demonstrating its ability to hover in a slight breeze, and to take off or land on any open spot of pasture. Most of this Kellett pioneering was during the most severe depression the U. S. and the world had ever experienced. It required faith to carry on with confidence in the goal ahead.

Today, Kellett's expanding staff of engineers, backed by this fifteen years of charting new paths, looks forward to Peace—when developments in rotary wing aircraft will have opportunities to serve in the patrolling and servicing of cross-country electric lines and oil pipe lines, in spraying and dusting agricultural crops, in ranching, forestry fire patrol—and many more ways. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

Eight years ago—a U.S.A.A.F. Kellett taking off from in front of the Operations Hangar, Wright Field, Dayton, O.

KELLETT

OLDEST ROTARY WING AIRCRAFT MANUFACTURING COMPANY

(*Continued from page* 130)

Don't mention buses to any of the aviation writers who made the recent visit to Army and Navy installations at Dayton, Dallas, Fort Worth, College Station, and Corpus Christi. Somewhere along the line was 150 miles of back-breaking bus ride through mud and floods and rainstorms. One classic remark of the trip was an AWAer's retort, "We now know all the cold fronts by their first names."

• • •

The Germans are said to have tried a new weapon against Britain's radar detection system—strips of aluminum-coated paper which are dropped from Nazi bombers in an effort to jam the British radar mechanism. The strips are called "radar flutterers" by England's radar experts.

• • •

Pilots returned here from the Pacific report that Jap flyers are like the little girl with the curl on her forehead—either very. very good or lousy. "Some days they will be very good and other days they will mill around independently of each other with no pattern to their attack at all," says Lieut. (j.g.) Ike Kepford of Muskegon, Mich., former Northwestern University halfback, now of the famous "Skull and Crossbones" *Corsair* squadron, who has 16 enemy planes to his credit—the Navy's leading ace. . . Incidentally, the squadron has a Pacific record of shooting down 154 Nip planes in 79 days of combat. . .

• • •

"The Order of the Clouds," a special Chinese award seldom made to foreigners, was presented here recently to a TWA flight crew in the name of Chiang Kai-Shek by Maj. Gen. P. T. Mow. Capt. C. N. Shelton of Salt Lake City and his crew of six got the award for the flight which took Madame Chiang back to China last July. . . Shelton was also in command of the plane which brought her here in November, '42, and flew her and her husband to Cairo to see the President and Churchill. He is 35, has been flying since 1927, and has logged more than 11,000 hours. . .

• • •

If you want to develop something for aviation you can get $75,000 to help out—if you can gain the approval of the Federal Government. . . Since 1927 authorization for such a grant has been on the books (see U. S. Code 10, paragraph 310, sub-paragraph R) but only once has any money been awarded, and then only after an experiment had been completed. Your project will have to be approved by the assistant secretaries of Navy, Commerce and War in charge of aviation matters before you can pick up the chips. . .

• • •

That recent coast-to-coast flight of a stock model *Mustang* must have given German engineers something to think about. Average speed for the trip was over 360 m.p.h.—which means that the *Mustang* often *cruised* over 400 m.p.h.

—FRED HAMLIN

Seabees at Work

(*Continued from page* 30)

A three-foot pipe roll made from an eight-inch channel and two-inch shafting, with gears from a discarded marine engine water pump.

A bolt-threader constructed from an automobile transmission and a pipe vice.

A 30-ton hydraulic press built with eight-inch channel and an hydraulic jack.

A lawn mower, complete with two-h.p. motor and set of tires.

"When am I supposed to let go of the propeller?"

Seabee construction works are ingeniously designed so that a large part of the facilities already built can be rolled up and moved forward as the action proceeds. This effects economy in men, materials, equipment, money.

The superiority of Seabees to Japan's own construction crews and engineers was best indicated on Attu Island, in the Aleutians. The Japs spent 20 months trying to complete a runway in poor terrain at Holtz Bay on the northern shore.

Within a comparatively short time after Army troops landed on the island, Seabees cleared their own site and put it into operation.

Supplies stored by Seabees in Seabee-built warehouses, planes from runways carved out of volcanic rock, and big guns mounted on Arctic shores all played a part in driving the Japs out of the Aleutians.

While most of the Seabees' work has been in the Pacific, they also have taken part in the campaigns of French Africa, in Tunisia and Italy. They have helped construct installations in the British Isles.

Seabees often are detached in groups for special work. They repaired the aircraft carrier *Enterprise*, damaged in a previous engagement, while en route and during a battle.

Another example of their ingenuity was the construction of a road over muddy terrain on Rendova Island while American forces were moving forward to capture Munda. The ground was so soft that heavy vehicles and guns could not be moved to forward areas. Even tractors bogged down.

Seabees turned to a grove of cocoanut trees, cut logs and constructed a good corduroy road—one of the oldest American methods for improving a roadway over soft mud.

But the Seabees were not content to put in a strip that was merely useable. Admiral William F. Halsey, Jr., Allied commander in the South Pacific, called the Munda field "the best in the world."

The late Secretary of the Navy also

Most significant contribution to safer take-offs and landings was the development by Douglas of the tricycle landing gear and its use on large aircraft. Thus were the hazards of ground loops and noseovers eliminated.

Adapted to the Douglas Dolphin in 1936, the tricycle gear was next used on the mammoth B-19, the DB-7 Boston, the A-20 Havoc, the DC-4 and the C-54 transports.

Altho an independent development by Douglas, full engineering data on tricycle gears was available to other manufacturers, resulting in safer take-off and landing characteristics for many planes.

First AROUND THE WORLD · *First* THE WORLD OVER

Douglas
AIRCRAFT

DOUGLAS EQUIPPED AIRLINES: American Airlines — Hawaiian Airlines Ltd. — Braniff Airways — Chicago & Southern Air Lines — Colonial Airlines — Delta Air Lines — Eastern Air Lines — Western Air Lines — Northeast Airlines — Northwest Airlines — Pan American Airways — Pennsylvania-Central Airlines — TWA — United Air Lines — China National Airways — Pan American-Grace Airways — Avianca (Aerovias Nacionales de Colombia) — Cia. Mexicana de Aviacion — Panair Do Brazil — Cia. Nacional Cubana de Aviacion, S.A. — Uraba, Medellin and Central Airways — Cruzeiro do Sul (Brazil) — Primeas Lineas Uruguayas de Navegacion Aerea, S. A. — Aerovias de Guatemala, S. A. — Canadian Pacific Airlines — Australian National Airlines — Royal Dutch Airlines (K.L.M.) — Royal Netherlands Indies Airways (K.N.I.L.M.) — Sabena (Belgian Congo) — Swissair (Switzerland) — A.B. Aerotransport (Sweden) — Indian National Airways — L. A. P. E. (Spain) — Aer Lingus (Ireland) — American Airlines of Mexico — British Overseas Airways (BOAC) (England).

paid high tribute to the Seabees when he told how they constructed one of the biggest flying fields in the world on Upolu Island in the Samoan group. Five planes can take off abreast from the broad runway which is surfaced with crushed, volcanic rock.

The Seabees got their baptism of fire when they followed up the Marine invasion of Guadalcanal in August, 1942. They went to work immediately on the nearly-completed Jap airstrip which later became famous Henderson Field.

The first Silver Star was awarded posthumously to S/2C Lawrence Meyer, of Toledo, Ohio. While working on Henderson Field, October 3, 1942, Meyer manned a machine gun in a pit where he had taken shelter during a Jap air raid and shot down one Jap plane. Two weeks later he was killed when an enemy bomb struck a pontoon barge loaded with gasoline.

In the summer of 1943 Seabees completed a short but famous line: "The Guadalcanal, Bougainville and Tokyo Railroad." It took them just three days to build the mile and one-quarter railway and three more days to complete its pier terminus.

Shortly after, a freight train of flat cars loaded with oil drums chugged a modest 10 m.p.h. over the route.

The Seabees set another record when American forces invaded the Gilbert Islands in the Central Pacific in November, 1943.

While Marines were killing Japs around them, Seabees rebuilt the captured Jap flying field on Betio Island. The first U. S. plane landed on the field four days after the invasion started.

The Jap strip on the island, however, was suitable only for fighter planes. Rather than waste time, Seabees built their own flight strip adjacent to it, put it into immediate use, and then rebuilt the enemy field. The entire job took only 10 days.

There is a wide distribution of crafts in every Seabee organization so that they are able to turn to any problem.

Their accomplishments are best described by their slogans. They have emblazoned on their banners these words: "We Do the Difficult Immediately. The Impossible Takes a Little Longer."

At first their watchword was "Can Do." Now it has become: "Can Do—Will Do—Did." END

Lightplanes for War

(*Continued from page 27*)

There was smooth staff work and the closest co-ordination and understanding at all times.

Instances of the Russian use of lightplanes to attack ground troops can be multiplied many times. Letters found on the enemy in Russia report that the U-2 pilots cut their engines and glide down slowly over the targets at night, dropping anti-personnel bombs with deadly accuracy, sometimes by hand. They are able to fly winter or summer, from tiny fields near the front that would never permit a modern fighter plane to land or take off, and in weather that grounds every other warplane in the theater.

The Russian use of lightplanes for tactical operations, oddly enough was inspired by an ardent United States lightplane enthusiast, Lieut. Col. John C. L. Adams. Lieutenant Colonel Adams is a U. S. Army infantry officer, now overseas, whose recent monograph on lightplanes, "America's Secret Weapon — the Lightplane," is a detailed manual listing many hundreds of uses for lightplanes by the armed forces. Originally restricted, this monograph can now be made public.

Lieutenant Colonel Adams is not an air officer and has always made ground troop tactical operations his first interest. He feels that ground troop commanders, having spent many years actually on the ground with their troops, can more quickly realize the battle needs of their commands than air officers who are not necessarily familiar, except in theory, with ground troop operations.

He believes that the ground forces should immediately obtain thousands of lightplanes and fly, maintain and command them as organic parts of their units. Above all, he insists that the pilots who fly them must be trained ground fighters first.

He would not interfere with the present organization of the Air Forces for strategic purposes. But he believes that the lightplane is ideally fitted for tactical cooperation with the ground forces—a type of operation with which the AAF at present is less concerned than with strategic operations.

Lieutenant Colonel Adams is a lightplane pilot of many years experience. He has studied the uses of lightplanes by the ground forces since 1935. He has flown a lightplane from the United States to Panama. Many of his writings have been translated into German, Italian, Russian and Dutch, and the Russians, at least, have freely credited his suggestions with the origin of some of their lightplane experiments.

He cites many advantages of lightplanes in flying characteristics, cost, training economy, troop-landing ability, tactics, ease of handling, shipping economy, uses in transporting materiel, mass productibility and potential armament.

His specifications for the military lightplane include a wing loading of six to eight pounds per square foot, compared with warplane loadings of 25 to 60 pounds. Low landing and take-off speeds would enable them to use small fields. They would be light enough to permit one man to handle them on the ground and would

(*Continued on page 140*)

FLYING

"I knew that guy when he drove a cab in Brooklyn!"

MIRACLE RESCUE

...a Story of Truk

Jap fliers had spotted our fleet far out at sea on that memorable mid-February afternoon. Truk—chief stronghold of the Nips in the Carolines—was warned and ready. But our Naval strategists had planned carefully for Victory. Our task force closed in resolutely for the initial blow at the powerful Jap base . . . a smashing pre-dawn attack which was to put 23 enemy ships and 201 of his planes out of this war for good!

As our fighters and dive bombers swooped down into the murky haze of the Truk lagoon, they were met by deadly flak from rows of enemy ships and shore batteries. The fighter plane flown by Lt. (j.g.) George N. Blair, USNR, daring 22-year-old pilot from Sewickley, Pa., was hit repeatedly. At 300 feet, Blair felt his engine freeze, his propeller stop. With cool American nerve, he negotiated his landing in the rough waters of the lagoon—the very heart of the Jap island-fortress!

A Hellcat (on wheel gear) goes down fast at sea. So fast, Blair could not retrieve his rubber boat. Treading water with the help of his "Mae West," Blair struggled free from his parachute harness and took stock of his plight. Desperate? Well did Blair know! But his decision proved the mettle of our Navy pilots. He would not swim toward hostile shores. Instead, he would take the *one-in-a-million chance* of a rescue in full view of watching slant-eyes.

The Japs on a destroyer decided Blair was a sitting duck. Twelve times they trained the fire of their 5-inch guns (!) on him before two of Blair's fighter-pilot wingmates could dive their planes to strafe the destroyer. But strafe it they did—set it afire, and turned it back! "It was mighty comforting," said Blair.

For three long hours that seemed an eternity, his spirits rising and falling with each circling and passing plane, Blair drifted about waiting for help to come. Then a Kingfisher whizzed by overhead! The seaplane pilot, at first, failed to spot Blair. But Blair's fighter friends soon guided the Kingfisher to their buddy in the water.

Every minute counted now. The surface of the great lagoon was rough . . . dangerous for a landing. But OS2U-3 pilots are skilled. And Edo floats can "take it." Without hesitation, Kingfisher-pilot Lt. (j.g.) Denver F. Baxter, USNR, of Summertown, Tenn., "bounced in" for a safe landing. With the help of Radioman Reuben Hickman, Blair climbed aboard and crowded into the rear cockpit. The Kingfisher had been stripped of all extra gear—to assure quick take-off with Blair's added weight. Up rose the Kingfisher, now protected by circling fighters. *One of the Navy's most daring rescues at sea was written into the history of the present war.*

Lt. Blair had seen Truk at close hand . . . too close for comfort. But thanks to the resourcefulness of Navy pilots—and the seaworthiness of rugged Edo floats on our Navy planes—he was returned safely to duty. His shipmates call him "the luckiest man in the Pacific."

ARMY E NAVY

EDO FLOAT GEAR

SERVES THE UNITED NATIONS

EDO AIRCRAFT CORPORATION, 414 SECOND STREET, COLLEGE POINT, L. I., N. Y.

It's Houdaille's Job, Too!

Underneath the pilots of this fast-landing bomber is a nose wheel.

Formerly, its tendency to shimmy violently was a major threat to safe landings and take-offs.

Today—on thousands of fighters and bombers, and on the tail wheels of huge cargo planes—the Houdaille* Hydraulic Shimmy Damper keeps these pivoting wheels in firm grip which "tightens" as shimmying forces mount and relaxes when slow speed steering movement is desired.

● The Hydraulic Shimmy Damper is only one of the products which Houdaille-Hershey is producing in quantity for the aviation industry.

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GENERAL EXECUTIVE OFFICES: DETROIT

*Pronounced — Hoo-dye

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HOW FAR WILL YOU CRUISE in your Post-War Plane?

✓Check Your Range—500 mi...750 mi...1200 mi...

YES, it's just as easy as that to check your answers on our popular Aircraft Quiz. We want to say more about this Quiz, but first let us tell you what bearing it will have on your post-war traveling.

You'll cruise high, wide and handsome if you cruise in a Bellanca, and you'll easily outdistance many of your flying friends. Your week-end and holiday trips will be interrupted by few if any re-fueling stops. You'll go from point to point on the map with the greatest of ease.

Of course, your Bellanca plane cannot be delivered until after our war work is completed—and we mean, *completed!* But meanwhile, we invite you to do some hard thinking about *your own* needs for peacetime air travel. And here is at least one way your thinking can take a line of constructive action. Get your copy of our Aircraft Quiz and answer the many vital questions we have listed for our friends.

Cruising range is only one of these questions, but an important one. We've had a lot of experience with *range*. Remember, it was a Bellanca that flew first from New York to Berlin non-stop—first bridged the Pacific between United States and Tokyo in one hop! Other provocative Quiz questions touch on capacity, speed, engines, construction, types, uses, price and those many essential factors which help you to determine *what* aircraft you should select and *why*.

Let us mail you this interesting and useful Aircraft Quiz. Send us your name and address now, while you think of it! . . . Bellanca Aircraft Corporation, Dept. S-1, New Castle, Delaware.

BELLANCA

Keep on Buying
U. S. WAR BONDS

(*Continued from page* 136)

weigh only about 800 to 900 pounds. These combinations would help give them extreme maneuverability. They could approach their targets silently—especially with engine cut, when they take on characteristics of a powered glider. They would be safe and stable for hedge-hopping. They would have normal ranges of 400 to 700 miles and greater potential ranges. They should be able to land in 20-mile winds, have an average speed of 90 to 100 m.p.h. and stall at 32 to 47 m.p.h. They could be launched from trucks, railroad-car tops or PT boats.

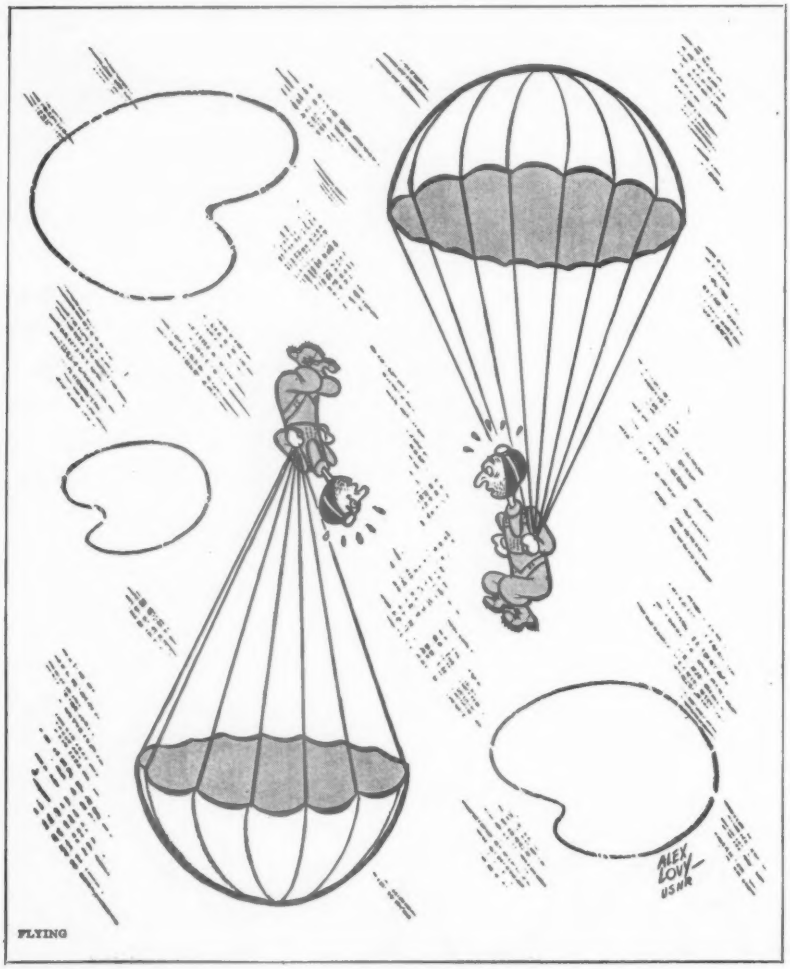
Lightplanes are economical to operate, costing only one to two cents per mile for gas and oil and using only five to seven and one-half gallons of gasoline per hour. They can use relatively low-octane gasoline. Their original cost is only $1,500 to $3,500. Their engines are accessible and easily repaired and maintenance requirements of the lightplane are only about 1/20 those of a fighter. Ground maintenance is cheap and simple.

Pilots are easily trained and physical requirements may be less rigid than for AAF pilots. The normal CAA course requires 10 weeks and makes the trainee competent to maintain the plane in the field as well as fly it.

It is claimed that lightplanes can land troops more efficiently than gliders. They can maneuver under their own power and can land in smaller and narrower areas and in places where no truck can reach. They can take off under their own power once they have landed. Ten to 15 lightplanes can be bought for the cost of a single glider and will carry 30 to 45 men, compared with only 15 in the standard glider. Net cost is said to be only one-sixth of the cost of glider transportation. Two thousand lightplanes costing $6,000,000 can theoretically deliver 48,000 men over an 80-mile jump in 24 hours, and most of the planes will still be available for freight hauling after the men are landed, Lieutenant Colonel Adams estimates.

Lightplanes are not tiring to fly over long periods and can often be flown six to eight hours per day without fatigue. The plane is able to duck away from enemy fighters, make short radius turns and fly contours close to the ground where it is a difficult target from the ground or air.

Lightplanes can be shipped with great economy of space. Five hundred of them can be carried dismantled in a single Liberty ship. Their gasoline economy saves much war theater transportation.



They can be used to supply troops. Three hundred to 400 lightplanes can completely supply an infantry division with food and ammunition from railhead under nearly any conditions. They follow no particular route, leave no tell-tale trail. They travel faster than trucks and a single lightplane should be able to deliver 800 to 1,200 pounds depending on overload and distance.

Lightplanes can be manufactured in the United States on an assembly-line basis. The United States has four or five lightplane engine factories. One factory should be able to produce a lightplane every 20 minutes when it is in full operation. No other country could duplicate such performance.

Equipped with a modified version of the "bazooka" rocket gun, the lightplane would have terrific firepower against other planes or ground targets. Because the lightplane is so maneuverable, it would be virtually impossible for any other type of plane or vehicle to out-maneuver it, whereas the lightplane could aim its rockets against any approaching target. It could also drop grenades or small bombs against personnel.

Most critics will admit many of Lieutenant Colonel Adams' contentions but argue that the lightplane would be too vulnerable in combat. He cites many examples to refute this and asserts: "The lightplane is the least vulnerable of all airplanes in war; it can live in enemy dominated skies and under conditions amidst which no other known type of airplane could survive."

He contends, first, that, properly handled, the lightplane cannot be seen by conventional aircraft and second, that it can outmaneuver them. When the king of Norway fled the Nazis in the invasion of his country, Lieutenant Lunt of the Norwegian Air Force used a Piper *Cub* on skis to maintain contact between the king hiding in the mountains and officials near Oslo. He flew very close to the ground and maintained contact in enemy-dominated skies for about three weeks. More than once German aircraft flew over without noticing him and at other times he would land and hide when he sighted enemy planes.

Another instance of the difficulty of locating such small planes was demonstrated by an RAF test in England. A camouflaged artillery spotting plane could not be found by a group of larger, faster planes even though their pilots knew that it was within an area of four square miles.

Lightplanes are so extremely maneuverable that fighter planes would have difficulty shooting them down, especially from the low altitudes where they would operate. A camera-gun test conducted by the field artillery concluded only that one fighter might be able to shoot down a lightplane if the pilot could see it, find it and engage it in a fight.

While 200-foot radius turns are easy for lightplanes, and under proper conditions they can turn in a 50-foot radius, the turning radii of many new fighters is 3,000 to 5,000 feet. Lieutenant Colonel Adams believes that the only plane that could consistently attack them would be other lightplanes and that the U. S.

TODAY, if ships are idle because engines are down for lack of repair parts, Kinner has a solution. For *there are no orphans in the Kinner family*—and no Kinner will ever be orphaned.

With WTS contracts cancelled, with private schools opening up again, and with CAP flying on the increase, the demand for exchange engines and factory rebuilds and major and minor repairs will be a problem for every plane owner. Here are suggestions to help solve some of them right now:

1. Exchange old Kinner or other engine for a new Kinner.

2. Send in your Kinner for complete factory rebuild.

3. Have your engine majored by an authorized factory branch using genuine, *always available,* Kinner parts.

4. If you operate Meyers OTW's or Fairchild 24's, get new power and performance with Kinner R-56. Change-overs can be made *right in the field.*

Write and tell us your engine problems. We'll help you work out a solution. Switch to Kinner—be sure of *always* getting parts.

Kinner radial engines 100 to 350 hp.

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would have an enormous advantage in this respect because we are the only nation that can produce thousands of them on short notice.

Lightplanes would "make a practice of never getting above 25 feet altitude over obstacles except in extreme necessity," he states. They would be operated in scattered swarms rather than in close formations. Granted this low altitude, he believes they would not be very vulnerable to ground troops since they would appear so suddenly and present such a fleeting target that the very surprise of the maneuver, possibly increased by dropping grenades, would serve as a protection. Many instances are on record to indicate that the lightplane has to be virtually shot to pieces before it is forced down. The hits must be made on the small areas presented by the engine, the propeller and the pilot. The latter might be protected by armor.

Vulnerability should be tested in actual combat "by a task force sufficiently large to really prove the results," Lieutenant Colonel Adams states.

He outlines a detailed technique of tactical employment. While flying at heights of only five to 25 feet above the terrain or obstacles, the pilot must be prepared to zoom over any obstacle suddenly encountered and be ever alert for hidden wires. He must be prepared to land straight ahead into any open space and be taught that he can crash-land the plane with relative safety to himself and passengers.

Lightplanes would always have a submachine gun and grenades readily available and would not have permanent heavy weapons mounted upon them. They might, however, be able to attack tanks and fortifications with low-recoil types of guns, mine throwers and new secret types of weapons. They should be equipped with an absolutely dependable starter in order to start engines following a power-off glide bombing or attack.

They would normally fly at least in pairs so that one could report the results of observations if the other were shot down. Lightplanes would habitually attempt to divert raiders from their true fighter missions.

Lightplane raider companies or larger units should include special types of planes particularly equipped to attack pill boxes, flame throwers, tanks, vehicles and similar targets. Special purpose planes would contain a large supply of explosives, tank mines, flares, gas and smoke. Each raider unit would include at least two planes equipped to lay smoke screens. All planes would be equipped with some small type of hopper from which self-arming grenades could be released.

Lieutenant Colonel Adams proposes basic principles of organizing lightplane units. Each plane should be a separate unit, like a squad, and would normally contain a leader and two or more men. The leader would usually be the pilot though all men must be able to pilot the plane in emergencies. Each crew member would be so armed that he would become a well-equipped ground fighter if the plane were damaged and the squad were forced to operate on foot. There would be rifle squad planes, light machine gun squads, mortar squads, reconnaissance planes and command planes.

This is the basic organization only. There would be company organizations consisting of three combat platoons and a service platoon. The latter would consist of administrative and liaison sections, maintenance section, supply section and mess section. There would be a total of 56 planes in a company or troop and three companies to a battalion, with a total of 175 planes under such a table of organization. A regimental organization would normally embrace three battalions plus about 35 or 40 planes assigned to regimental headquarters. Some of the regimental planes should be heavier and faster types in order to control the widespread lightplane operations. Several large cargo planes also would be necessary.

Lieutenant Colonel Adams visualizes the ideal lightplane as weighing less than 900 pounds, with a landing speed of 47 m.p.h. and able to take off with a gross load in 500 to 600 feet or less. Wing spread should not be over 36 feet and the plane should be able to carry a normal load of 800 pounds plus an overload of 400 pounds in emergencies. He recognizes that no plane now available will meet these specifications but believes there is no reason why it could not be

(*Continued on page* 146)

Naturally, Particular Pilots Look to SNYDER to Keep Their Planes in the Air

Private pilots and successful base-operators are pretty finicky in everything pertaining to the servicing and maintenance of their planes. It's a matter of pride as much as safety. So, they just naturally turn to SNYDER's.

They know that SNYDER's huge stock of supplies — over 15,000 different items — includes the most outstanding names in the industry. They know, too, that SNYDER has the complete shop and plant facilities, the skilled technicians, and the co-ordinated teamwork to do a precision job on every part of a plane at once — that SNYDER's standards are high and exacting and that SNYDER's guarantee is recognized by plane-owners and operators throughout the nation.

And here's another thing — SNYDER's broad experience is placed willingly at the service of pilots and owners, whether there's an order involved or not. All you have to do is tell SNYDER your problems, and you'll get prompt and unbiased counsel that you can rely on.

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(*Continued from page* 142)

designed.

He cites hundreds of uses of lightplanes with the infantry, artillery, cavalry, armored forces, anti-tank units, airborne units, supply, Navy and for special purposes.

Uses with the infantry, for example, would vary as widely as identifying targets, attacking specific objectives, and carrying cable lines across rivers. They would include such widely diverse uses as directing traffic to and from the battlefield; as aerial scouts and observers, and psychological harassment. Lightplanes would be used for general reconnaissance; fire direction; laying smoke screens; transporting men and supplies and carrying messages. They could locate lost units; participate in rearguard actions; make night gliding attacks; attack enemy snipers; drop incendiary bombs; maintain communications in various ways. They could select rallying points for tanks or scattered units; locate enemy weak and strong points; seize, destroy and defend bridges; estimate ranges. They could transport mountain artillery pieces, crash-landing if necessary. They could assist in co-ordinating ground attacks by signals and flares. They could replace gliders.

Considering all these advantages, Lieutenant Colonel Adams asserts: "We must not wait another 20 years and permit an enemy in a future war to take this peculiarly American weapon—the lightplane—and use it against us. We must not allow to become true the premonition of the lightplane advocate who offered the following toast, 'Gentleman, I give you the lightplane. Shall we have it now or later?—Too much later?'" END

Constellation Flight

(*Continued from page* 68)

country champ—6 hr. 57 min. 51 sec.

On February 20, 1935, Leland S. Andrews and H. B. Snead had flown their single-engined Vultee transport from Los Angeles to Washington in 10 hr. 22 min. at an average speed of 221.6 m.p.h. And on January 19, 1937, Hughes himself piloted a specially-designed plane from Burbank to Newark, N. J., in 7 hr. 28 min., making the crossing at an average speed of 327 m.p.h. That seemed about the irreducible minimum until the *Constellation* [and, a few weeks later, a *Mustang*] came along.

Eight hours before the *Constellation* took off from Burbank, a TWA DC-3 took off from Los Angeles on a scheduled commercial flight to New York. It arrived in New York three hours after the *Constellation* had landed in Washington.

The *Constellation* carried 17 persons on its record flight. It had luxury accommodations for 43 more. It could have carried 100 soldiers with full equipment.

Performance figures on the flight are restricted. It is estimated, however, that the *Constellation* used about 3,000 gallons of gasoline. And it is permissible to say she had considerable fuel in reserve.

If the world were at peace, the *Constellation*—and many planes like it—doubtless would already be in coast-to-coast passenger service.

This was part of the Hughes-Frye idea when they first conceived the plane five years ago. TWA originally contracted with Lockheed for 40 *Constellations* but turned the contracts over to the Army when war started. The first *Constellation* completed at Lockheed's Burbank plant went into the Army last July and is now being kept at Lockheed for testing purposes. This is the second *Constellation* and has gone to Wright Field. As others leave the plant they, too, will join the Army.

Just how the Army will use them is a military secret. *Constellations* would prove especially valuable as hospital planes. They could evacuate a greater number of wounded in greater comfort because of the speed and capacity of the plane and its ability to fly at high altitudes where the air is smoother.

The pressurized cabin of the *Constellation* is an important advantage for carrying wounded men who, as a rule, cannot take high altitudes. The rate of change of pressure in the *Constellation* cabin can be adjusted so that the plane can ascend or descend at 2,000 feet per minute while the cabin pressure changes only at the rate of 500 feet per minute.

The Army could put planes of the *Constellation* class to work in the task of rotating troops who have been on distant battle fronts for long periods of time. A ship carrying 1,000 troops would require approximately five weeks to travel from Australia to San Francisco. Ten *Constellations* could pick up the same number of troops in Australia and deposit them at San Francisco about 32 hours later, and fly the same number of replacements back to Australia in the same length of time.

The *Constellation* is able to get into and out of small fields. At sea level, its 8,800 h.p. will permit take-offs from a runway of less than 1,500 feet. Its landing speed is less than 80 m.p.h. and flaps make it possible for the craft to stop in a remarkably short space.

Some idea of the tremendous size of the *Constellation* can be gained from these statistics:

From wing tip to wing tip, it spans 123 feet. Its overall length is 95 feet—nearly one-third the length of a football field.

Its overall fuselage height (static) is 18.8 feet and a 12-foot unloading carriage is necessary to get passengers into and out of the plane.

It can carry a payload of 14 tons.

There is enough radio and electric wiring in the plane for 31 homes of six rooms each. In all, there are 2,500 separate wires with a total length of 35,000 feet—nearly seven miles. The interphone system consists of stations for pilot, co-pilot, engineer, radio operator, navigator, cabin entrance door, at every nacelle and at external battery receptacles.

It has nearly a mile and half of metal tubing with 1,500 separate tubing assemblies. About 1,500 square feet of Alclad were needed for the plane, together with 650 pounds of dry paint primer.

The *Constellation* can lift its 80,000 pounds to an altitude of better than 30,000 feet. With one engine cut, the plane can achieve an altitude of 25,000 and it can take off and cruise to 16,500 feet on only two engines.

Each engine is controllable by either pilot and adjustable from the flight station by the engineer.

(*Continued on page* 150)

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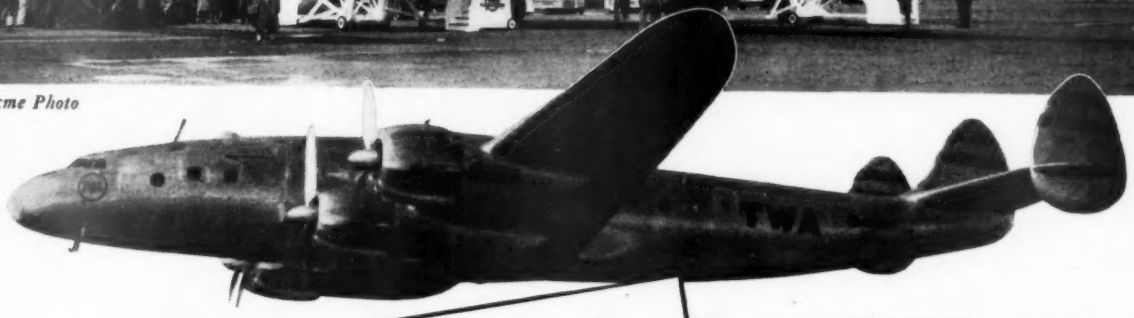

Hurtling cross-country at an average speed of 355 m.p.h., TWA's sleek new Lockheed Constellation arrives at the Washington airport with a new record of 6 hours and 58 minutes. This largest transport plane in the world has been turned over to the Army for whom it can carry 100 soldiers with full equipment.

RECORD-SMASHER

—the shape of things to come!

Our hats are off to TWA and Lockheed. Their magnificent Constellation which recently shattered all coast-to-coast records, is more than a superb example of American designing and engineering genius. It is a glimpse into the future . . . a concrete prophecy of finer, swifter air transportation in the days to come.

It is only natural that we at CECO feel a glow of pride that CECO CARBURETORS have been chosen for this newest giant of the skies. And in the future as in the past, our combined efforts will be concentrated on building finer and still finer products for the "record-smashers" of the years ahead.

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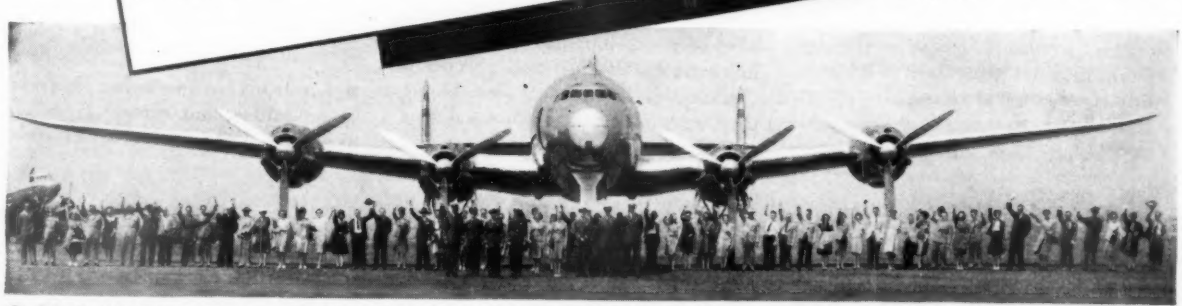
Wingspread on this streamlined beauty is 123 feet — longer than the first flight of the Wright Brothers at Kittyhawk.



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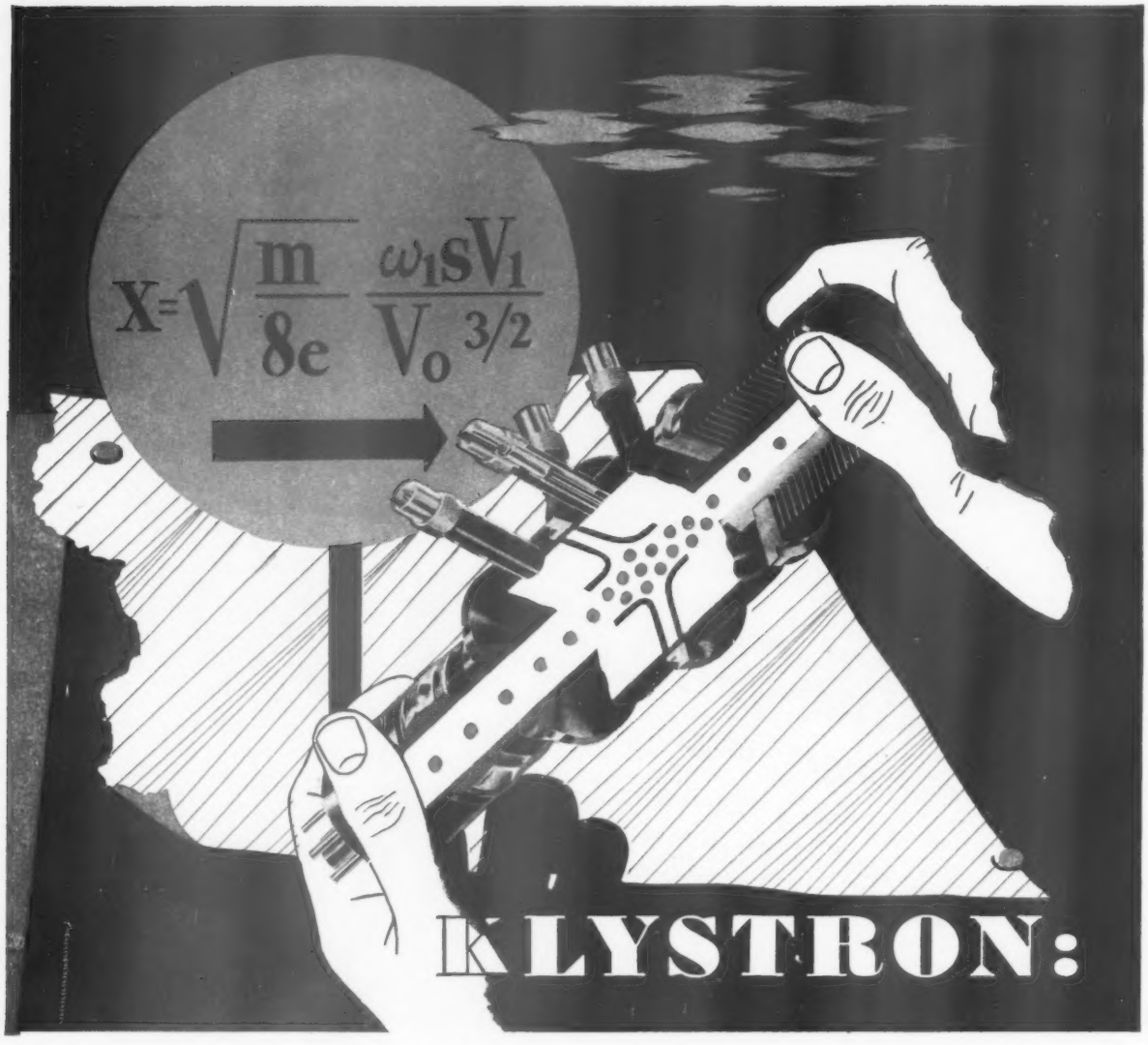

Mathematically, here's the inside story

THE FORMULA in the picture above is an expression of *bunching* as it takes place in the Klystron tube.

This Sperry tube converts DC energy into radio frequency energy by allowing an electron beam to become bunched, or pulsating, between spaced grids.

▶ The ultra-high-frequency micro-waves thus generated can be concentrated into a narrow beam and directed with great accuracy.

Various other forms of the Klystron have been developed by Sperry to aid in the amplification and reception of ultra-high-frequency waves. Today they are vital parts of many a device used by our Armed Forces.

The name "KLYSTRON" is a registered trade-mark of the Sperry Gyroscope Company, Inc. Like other Sperry devices, Klystrons are also being made during the emergency by other companies.

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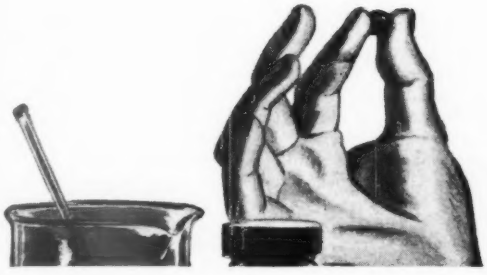
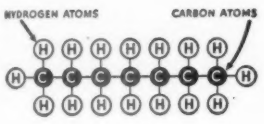
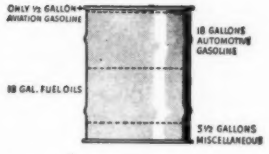
These pills help cure the high-octane headache





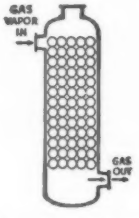
This is a molecule of ordinary gasoline. Like any gasoline it will burn, but this arrangement of atoms causes severe detonation in high-compression aircraft engines.



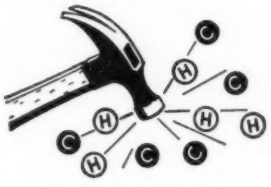
Old-fashioned refining produced some gasoline that *was* good enough for aircraft engines—but only a little, and it wasn't good enough for today's planes.

The more plentiful ordinary gasoline *can* be turned into high-octane aviation fuel if its hydrogen and carbon atoms are rearranged to form a different kind of molecule.

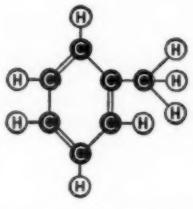
The new catalyst developed by Standard of California does the trick. A catalyst *causes* a change in gasoline but does not actually enter into the new product.



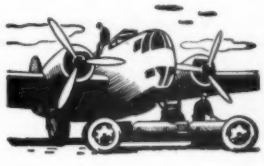
Here is how it is used: Ordinary gasoline, vaporized, goes into a chamber filled with millions of these little catalyst pills. When the vapor touches the catalyst—



its molecules are split open and the atoms arranged in a new pattern. Our scientists devoted years of research to finding the catalyst that would accomplish this best.



This is how the molecule looks after it has been reformed by the catalyst. Standard scientists have made it non-detonating. It is now safe for aircraft engines.



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(*Continued from page* 146)

Each unit packs 2,200 h.p. into a 55-inch diameter and has a nose section specially designed to permit use of a close-fitting cowl to decrease air resistance further. The 55-inch diameter is the same as that of the original nine-cylinder *Cyclone* which was introduced in 1927 with a rating of only 525 h.p.

Each engine weighs just fractionally over one pound per horsepower.

Wright engineers designed a special gear reduction system—with what is probably the lowest ratio (less than half of crankshaft speed) ever used on any aircraft engine. The propellers are Hamilton Standard hydromatics.

In designing the power plant installation, special emphasis was placed on maintenance and serviceability. It is possible to make a complete engine installation in about 28 minutes.

Two-speed gear-driven superchargers begin operation the moment the plane leaves the ground. TWA estimates that the unusual economy of operation reduces existing mile costs by 20 per cent.

Among the men credited by Hughes and Frye for making their dreams come true are Capt. Lawrence Chiappino, Joe Towle and R. L. Thoren.

"Chip" Chiappino is a check pilot for TWA's Intercontinent Division. He has flown in virtually every corner of the world. From the University of California, he went directly to Army flying schools "because there was nothing else I wanted to do but fly." He trained at Brooks and Kelly Fields. Since 1928, he has amassed 14,400 flying hours which have added more than 2,200,000 miles to his travels.

Joe Towle, 39-year-old native Oregonian, is an engineer and test pilot for Lockheed and has flown since 1928. He holds the record for a flight from Capetown to Pretoria—800 miles—made while delivering a *Lodestar* to South African Prime Minister Jan Christian Smuts, whose personal pilot Towle checked out. These and other assignments have added up to 5,000 flying hours.

As chief flight test engineer for Lockheed, bespectacled Rudy Thoren knows perhaps better than any other man what makes the *Constellation* tick. At 32, he is a veteran in aeronautics. He took up flying at 17, teaching himself with a glider he built in his native Negaunee, Mich. A year later, he installed a motorcycle engine—"I didn't believe the Wright Brothers had covered things sufficiently." Eventually he cracked it up. This sent him to the University of Michigan Engineering School for a course in plane designing and building. He has served as flight test engineer on *Hudsons, Lodestars, Venturas, Lightnings,* and the *Constellation.* In many tests he rode piggy-back with Towle (with parachutes, too) and the pair earned the nick-name "piggy-back twins".

Exhaustive wind tunnel and laboratory tests made the performance of the *Constellation* a certainty long before it ever left the ground. These tests were worked out in such minute detail that the actual test flights were routine.

Principal test stages in the development of the *Constellation:*

1. Wind tunnel to test speed, take-off, load and control characteristics.
2. Laboratory tests of the hydraulic, control, flap and landing gear systems.
3. Engine flight tests.
4. Actual flights.

A nine-foot model complete with running engines was set up in the wind tunnel, simulating actual test-flying conditions. Power effects were noted with one, two and three engines out. Wing flap settings were tested.

An exact duplicate of the hydraulic and control systems was set up in the laboratory. This included cockpit controls and a control stand. Four Ford motors drove the hydraulic engines, making it possible to simulate landings and take-offs. Flying in cold weather was simulated through use of cold boxes. Experiments showed the systems could operate at a temperature of 70°.

There were on-the-ground endurance tests for the various parts. Each part was put through a severe trial—500 hours of simulated flying time with full deflection of controls at short intervals. These 500 hours of testing represented thousands of hours of actual flying since, in actual flight, all controls are moved rarely or, at best, gradually.

The power plants were run through three sets of tests, with Wright engineers working at the Lockheed plant on all engine problems.

The tunnel model was set up to test air flow through each engine and determine whether the cooling flaps were effective. Test block experiments followed, then two complete power plants were mounted on a *Ventura* frame so that whatever "bugs" there were could be worked out of the engines before they went into the *Constellation.*

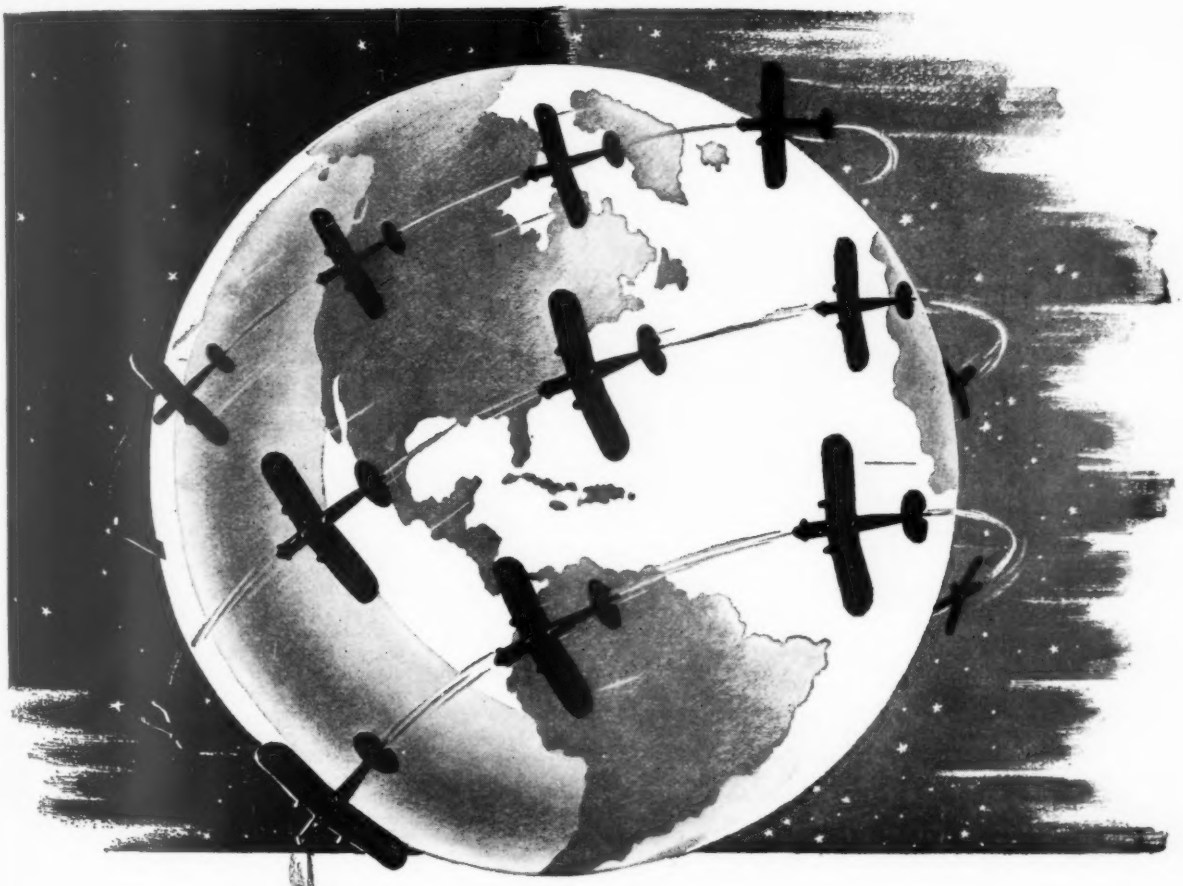
Test crews called this combination of *Ventura* plane and two *Constellation* engines the "Ventillation." Some of the more imaginative testmen had another name for it—"Sweater Girl".

Fuel consumption, engine performance and virtually all other problems were worked out in these tests.

Then came the first actual test flights on the first *Constellation,* predecessor of the one which made the cross-country journey. Before *Constellation I* took off, a water ballast system was installed to simulate all types of loading conditions. This system consisted of 17 tanks, with 130 gallons capacity each, distributed throughout the plane to represent loads and connected with pipes and valves which made it possible to shift loads in flight with the turn of a hand.

The first actual test flights with *Constellation I* were made January 9, 1943. Six test flights were made that day—three by Lockheed's Milo Burcham and three by the late Eddie Allen of Boeing who noted after his turn at the controls: "This thing works so perfect you don't need me around anymore."

United States peacetime service *Constellations* will be used primarily for speedy, deluxe travel passenger service capable of flying from New York to Los Angeles in 10 hours with one stop along the way—or approximately nine hours or less non-stop with full load. TWA esti-



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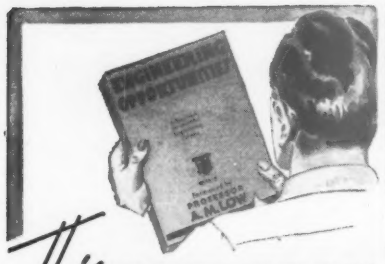

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mates that the *Constellation*, carrying 50 passengers and baggage in peacetime service and allowing for intermediate stops, would fly from Washington to London in 13½ hours, Washington to Honolulu in 18 hours, to Tokyo in 28 hours, Moscow in 19⅓ hours, Manila in 35 hours, Melbourne in 42 hours, Chungking in 35¼ hours and Paris in 14½ hours.

Peering into the not-too-distant future, Frye predicts that planes of the *Constellation* class will be hauling all types of cargo to all parts of the world in peacetime commercial service, and at rates to fit middle income pocketbooks.

He expects TWA will have at least 40 *Constellations* in service within five years after the war. END

Curve of Pursuit

(*Continued from page* 58)

pursuit curve in a fire cone which is at approximately a 90° angle to the bomber, the gunner aims past it toward the tail of his own plane by three rads. If he is coming at a 45° angle, the trail is two rads; one rad at 22½°, and half a rad at 11¼°.

That deflection theory is based on a true air speed of 225 m.p.h. for a bomber and 325 m.p.h. for the fighter. Although the changes in the speed of a fighter plane on the pursuit curve has almost no effect on deflection, the deflection from the bomber must be increased ¼ rad for each 25 m.p.h. increase in the bomber's speed, and decreased ¼ rad for a similar decrease.

Colonel Huglin explains that the bullet keeps the forward speed of the bombing plane no matter what direction it travels —above, below or to either side. If the gunner leads the plane attacking from the rear, he will miss because he did not allow for the forward speed. And if he forgets to lead a plane attacking from the front back toward his own tail, he also misses.

The only time there is no deflection is when the fighter is approaching from dead ahead or dead astern. However, when he is diving at you from dead ahead, you must aim *above* him and when he climbs up at you from the head-on position, you must aim *below* him. If he deviates off course from the true frontal assault you then deflect toward the tail of your own plane from the side from which he is attacking.

But when shooting at an attacker in a direct tail attack, the gunner must aim *below* the fighter when he dives, and must aim *above* when he climbs at the bomber. A deviation is compensated for in the same way—always toward your own tail.

In other words, if he comes at you almost dead ahead, but a little to the right, you deflect to the right. If it is from the left, you aim to the left of him. This is back toward your tail. If he is a little off dead astern, but to the right, you aim into the left. That, too, is toward your tail. And if he deviates to the left, you aim to the right.

Gunners using the Sperry computing gunsight have a somewhat easier task. They first identify the type of attacking plane, then set their sights according to its size and track the target long enough for the gunsight to "make up its mind." Then press the triggers! This is the closest thing to automatic extinction yet devised, the Army believes.

Plane recognition is the most important phase of this gunsight because identification of the enemy craft means that the dimensions of the plane are known. Then cross hairs, or reticles, in the sight are adjusted to bracket the target snugly.

Then comes the "make or break" part of computing sight operation. The gunner must hold his sights firmly on the enemy craft, tracking the target in its path through the sky—which amounts to stalking the prey for a few split seconds. If the sights are glued to the target, the movements the gunner makes with his guns in so doing are translated into the proper lead and deflection by the sight mechanism. Now, start firing!

Vital factors in this automatic computing are range of the target, position of the guns relative to the wind, and speed at which the guns are being moved. Range is a matter of perspective, the apparent measurement of an object of known dimensions being translated into distance, or range, by formula. The formula is solved by use of a dimension dial, worked by the gunner's thumbs, in all turrets except the lower ball turret, where that gunner employs his left foot to keep the plane in the reticles.

Wind involves more computing. A bullet travels in a curved path because gravity pulls it toward the earth in the course of its flight and wind causes it to deflect. When a bullet is fired from a bomber moving at high speed, there is a wind effect on the bullet equivalent to the speed of the bomber. These effects are compensated for by the sight.

What actually does the work is the speed at which the guns are tracked. If the gunner holds the target in his sights, he will be moving his guns in a direction and at a rate of speed that the computing mechanism of the sight can translate into accurate deflection.

The time element involved in setting the sights makes it necessary that the gunner get on the target at long range, tracking the fighter in on its approach and making adjustments with the reticles until the enemy is within firing range.

This Sperry computing sight reduces the human factor to a minimum. Previously, an aerial gunner had to estimate the range and relative speed of an attacking plane with his ring sights and by trial and error. His accuracy depended upon his own ability and experience. Tracer bullets were occasional aids but at long range they were deceiving. They often miss when appearing to hit.

Training aids at these western gunnery camps are ingenuous affairs. For instance, there is the Waller Trainer, which is composed of nine huge projecting machines geared to perfect synchronization,

"The Flying 75"

Through a tiny country village, far behind the lines, an Axis armored column rumbles toward the front. It's safe here for Nazi tanks, out of Allied range . . . Or is it? For suddenly, a formation of planes comes streaking into sight. They're "Flying 75's," bringing heavy artillery into action miles behind the front. Now, they're over the armored column, their cannon blazing . . . until the road is strewn with wreckage . . .

Yes, the heavy artillery has taken to the air! The same size of cannon that gained fame as "French 75's"—the same type Oldsmobile has been building for General Sherman tanks—now are being mounted in planes! And since the day when the first cannon-firing B-25 Mitchell bomber surprised an enemy destroyer and left it sinking, the "Flying 75's" have taken a heavy toll. We at Oldsmobile salute the men who made this development possible—the men of Army Ordnance, and the Air Forces, and North American Aviation, Inc. Until Victory, Fire-Power is *Our* Business. In addition to 75's for tanks, we also build another size cannon for tank destroyers, and automatic cannon for fighter planes, plus shell for both Army and Navy, including the size and type used by the "Flying 75's."

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7-44

which flash a horizon on a circular screen. These scenes portray how it actually looks to a gunner from his place in the airplane.

There are four different turrets, using radio beams as "bullets" which are fired at an attacking plane as it flashes across the screen. The four student gunners are scored by bursts of their radio guns and are shown at the end of their practice round exactly how many—or few—hits they registered. During the "firing," they also may be shown visually how to correctly aim at the filmed target and how many radii to trail or lead.

Then there is the Jam Handy Trainer, which is a smaller version of the Waller Trainer.

All these devices simulate the "feel" of the guns as they are shooting, and sound effects give a realistic atmosphere of actual battle during the entire practice session.

"Battling Brownies," or AN-1 gun cameras, also are used. These are placed on turrets and waist guns of *Flying Fortresses* and on the sights of planes with fixed guns. They work in synchronization with the triggers of the regular guns, which of course are not loaded with ammunition. The film is processed and numbered after each flight. From the developed motion picture film, the instructors can show the student graphically what his mistakes were. END

15 YEARS AGO

FROM the July, 1929, issue of this magazine:

Gen. William Mitchell stated that "armies have become mere holders of ground and air power is the only thing that can go quickly and surely to the vital centers of the enemy. If you tie aviation to an army you are going to stop its effectiveness at once." . . . He also said: "Air power will get a quick decision. The mere threat of its use may be sufficient to force a peace." . . .

Continuing their air transport cost studies for the magazine, Black & Bigelow estimated that the cost of operating 10-passenger airplanes on a projected New York to Cleveland route would be $1.319 per airplane mile on a basis of one trip per day; 86.8 cents per airplane mile on a basis of eight trips per day. Costs per passenger mile would be 13.2 cents per mile for one round trip per day, 8.7 cents per mile for eight trips per day. . . . The chief overseas markets for airplanes were Canada, Peru and Mexico. . . .

A newly-patented landing mechanism for airplanes used spring-equipped braking wings extending outward for frictional engagement with a recessed trackway for landing planes on roofs. . . . Lawrence B. Sperry patented an automatic pilot for airplanes. . . . END

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THE brother of a waist gunner on a Boeing Flying Fortress wrote Studebaker quoting him as saying:

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Comments like that are fully appreciated, of course. But Studebaker men and women know that what count most are the accomplishments of the stout-hearted air crews and rugged ground crews of our country's warplanes and the achievements of our fighting forces everywhere.

In fact, whatever amount of satisfaction the Studebaker organization may derive from the extent and consequence of its war work is always tempered by the realization that Studebaker is only one unit in a vast American fighting and producing team where everyone's effort is important.

Studebaker takes pride in its assignments on that team. Huge quantities of Wright Cyclone engines for the Boeing Flying Fortress—big multiple-drive military trucks—and other units of vital war matériel continue to stream forth from the five great Studebaker factories.

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Karl Stefan mc

CONGRESSMAN KARL STEFAN
OF NEBRASKA

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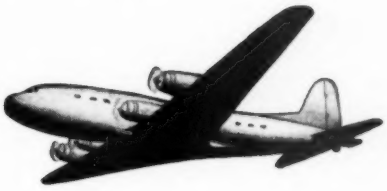

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California Flyers is engaged, today, in the production of vital aircraft assemblies, equipment for the famous B-17 Flying Fortress and Douglas C-47 transports. Except for special employee training given in conjunction with its manufacturing operations, no courses are being taught. No enrollments are being accepted. No registration fees are being accepted. However, California Flyers, still the pioneer, is looking to the future; aviation is approaching the stage of vast expansion, and with all its amazing progress, even more amazing things are to come. To encourage young people to take an interest in the opportunities which aviation will continue to offer when the war is over, the school is giving away an interesting, informative booklet. Its only purpose is to help you to visualize the future and to plan for your career. Keep it for reference. Use it as a guide in planning your preliminary vocational training. All you have to do is to be interested in aviation! The book is yours.

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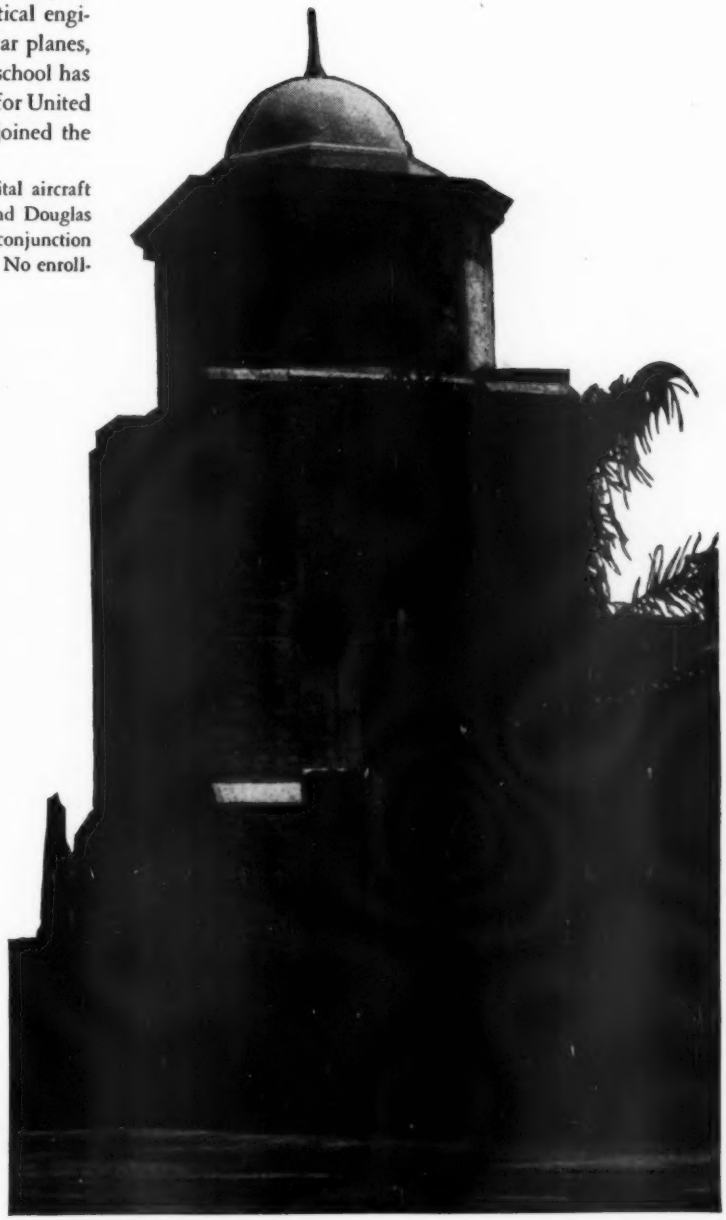

Letters

(*Continued from page 80*)

Discrepancy No. 3. "Altitude 2,000 feet, airspeed 500 m.p.h." How did he pull out? We recommend that the Pilots Information File be referred to and revised immediately, as it says that this is impossible.

Otherwise the article is very well written, exciting, even stimulating. We never even dreamed that diving and zooming through cloud-filled valleys drenched in glorious sunshine could be so death-defying, so gruesome.

He who puts his hands on the joy-stick, should beware of that most dreaded of all pilot-traps, *Vertigo*. After reading this article, we get shivers up and down our spines, but it isn't from vertigo.

Please don't print our names—for obvious reasons.

Army Air Field
Perry, Fla.

● Anything might happen when a pilot has vertigo.—ED.

USE HOKKAIDO?

Sirs:

Sen. Elbert D. Thomas of Utah, a long-standing member of the Senate Foreign Relations Committee, writes in FLYING for May of free world air routes. At this moment, the State Department is shying away from the American public knowing of discussions with others. I would ask the Senator to show concern over the secrecy of the negotiations which are not being held in this country.

The veteran Utah senator who has been one of the leaders holding for the preservation of that block-headed sun of heaven, Hirohito, hopes for a "permanent and workable peace."

No future peace is permanent or assured partially in the Pacific area unless the United States demands, and obtains, airfields in the mandated islands, Formosa, Manchuria and Hokkaido.

In the same issue of FLYING, Brig. Gen. Henry J. Reilly wonders what base could we use if the Soviets do not allow us to have Siberian fields. He holds the next best step would be recapture of, and use, of Philippine air bases. The general must not know of the extremely treacherous flying conditions between the Philippines and Japan—via Formosa.

I'll lay a good-size war bond that one of the finest bases we could use would be the island of Hokkaido. Hokkaido is of more importance for an attack on Japan proper than any base in the Philippines. Senator Thomas will perhaps want the Japanese to retain Hokkaido once we get it. That would be a shame. Make Hokkaido the main American North Pacific base between Alaska and China. The use of Hokkaido will eliminate the problem of Siberian or Kamchatka bases.

JAMES R. YOUNG
Author, "Behind the Rising Sun"
Pawling, N. Y.

BRITISH CRITICISM

Sirs:

Your December, 1943, article on the electric gun sight is a discredit to your magazine. The author, Wayne Gordon, was obviously too lazy or incompetent to ascertain the true facts. I base my contempt for him on the following:

1. He says British engineers started working on the sight either during or after the Battle of Britain. This is wrong. Many of these sights were fitted to fighter planes as long ago as 1938, some were on issue before that.

2. He says the sight is best used with the gunner's eye 17 inches away from the glass screen. This is untrue. The sight will work equally well with the gunner's eye as little as three inches away.

3. He implies the sight is used by free gunners. This is not so.

4. He states the sight solves the major sighting problems by means of altering the distance between the horizontal lines (controlled by the range and base controls).

This is a rank falsehood. The only aid given to the pilot when he alters the gap is that of a simplified method of range estimation.

I am forbidden by regulations to sign this letter.

RAF TECHNICAL OFFICER

● FLYING tried for months to obtain information on the electric gun sight, finally got most of its data from an RAF pamphlet, had the article approved by British authorities. Even so, last-minute changes necessitated stopping the presses after 100,000 copies had been printed. FLYING regrets that RAF Flight Officer received one of the first 100,000.—ED.

MORE PRIVATE FLYING

Sirs:

My ire has been aroused after reading your February issue. I have been a reader of your publication for some years and I feel it's about time someone gave some criticism of your selection of articles.

Your magazine being the only real vent to the views and news of private aviation, it is my belief that a great deal could be done to help the furtherance of private flying if more emphasis and criticism were presented to your readers, many of whom are in a position to help break down some of the barriers.

Since the war I have noticed very few articles about private flying, helpful hints, airport management, etc. . . .

The point your publication should emphasize and bring to the minds of its readers is the need for simplification of flying and its regulations. Igor Sikorsky said, "a plane in every backyard." Just try and land in your backyard without a lot of red tape. What is being done to control and simplify the controlling of future private flying? Are pilots just going to rush off cross-country like the gentlemen in your recent issue?

Civilian flying must not die. . . . Let's get out of short pants and take on some 1944 ideas and at the same time look to the future.

ROGER W. ANDERSON
South Arlington, Va.

● FLYING agrees with ex-AAF Pilot Anderson's formula, resents his accusation that we are ignoring private flying.

The April, May and June issues of FLYING contained 56 articles. Fourteen of these, or 25 per cent, were of special interest to private and commercial pilots, and seven of the 14 were right down the private pilot's alley. During those months, FLYING is proud to have published such articles as "Signposts of the Air", "Proposed CAR Revision", "Ultra-High on the Airways", "Post-war Private Planes" and others.

Because of wartime restrictions on private flying and the overwhelming interest in military aviation, FLYING feels that its allocation of space is reasonable, looks forward to the time when most of its articles will have direct appeal for private pilots.—ED.

END

THE FORMULA OUR ENEMIES FORGOT

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So, after victory let's profit by our enemies' mistake and not forget the formula that makes our nation great.

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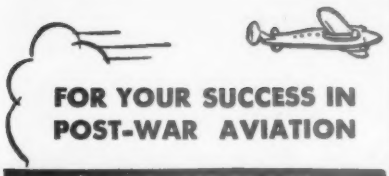

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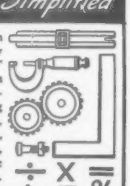

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Sky Highways?

(*Continued from page 23*)

through portions of three traffic control areas, lands, and is credited with four movements for the one flight. These figures are necessary in the operation of our traffic control system but give an erroneous impression of the volume of traffic.

The remark is often made that the air is "congested." Some seem to think that traffic in the air is as thick as pre-war Sunday motoring. According to recent information, the busiest airway in the United States is from Los Angeles through Tucson, El Paso, Fort Worth and eastward. Latest figures show an average of one aircraft passing along this airway every five minutes. If traffic doubled, so that one plane passed in each direction every 5 minutes, the air space within the airway would still provide ample room. At 200 m.p.h., five-minute intervals between aircraft would space them at an average of 16½ miles apart. This would not even be close if they all flew at the same altitude, which they don't.

One great weakness in our air traffic control system is that manual operation of the flight progress boards is too slow to handle present airway traffic. The addition of large numbers of air traffic control personnel has not solved this problem. To remedy this situation, it is now planned to install electrically-operated flight progress boards, at a fantastic price, and to add more air traffic control men to handle the work involved. Thus, we have a system which will constantly grow in direct proportion to the increase in air traffic.

Our airways are not congested, but our present system of air traffic control has reached the breaking point. Would not these facts indicate a traffic control system based on a fallacy? The present system is failing because an attempt is made to control each individual flight. Certainly this will become more impossible as volume increases.

Another great weakness in our traffic control system is that it handles only flights within the airways. Only those off-airway instrument flights which approach or cross civil airways are required to file flight plans. No provision is made for the unknown, unplotted flights that often unintentionally infringe upon this imaginary air-highway space. This unknown traffic constitutes the greatest hazard to flights within the airways—*and there are thousands each month!*

In order to safely control flights within airways it is necessary to know about *all* off-airway flights. Furthermore, due to the fact that weather changes rapidly, it is theoretically essential to plot all flights under contact conditions in order that their position will be known if instrument weather suddenly closes in. Expansion of the airway system will only add more confusion. There is an answer to the problem, but first let's look at one more important factor in the complete picture.

It is fortunate that radio ranges do not provide the only radio aid to air navigation. Within the past two years, additional use and development of the automatic direction finder, known to pilots as "ADF," has demonstrated its advantages

(*Continued on page 164*)

Postwar... you'll fly way up there

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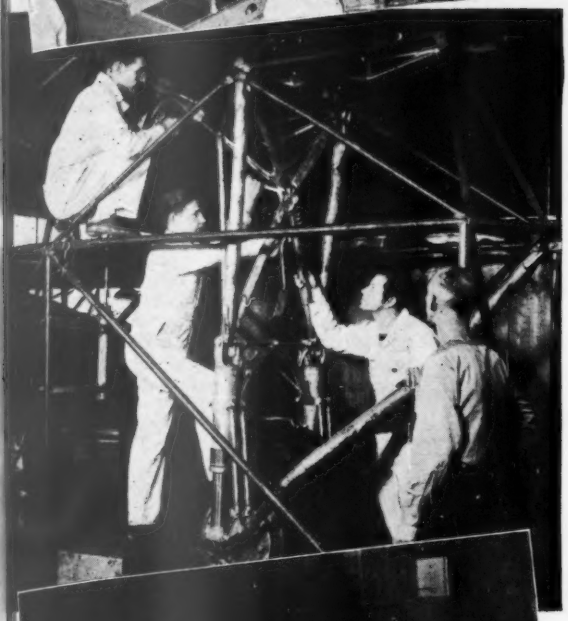

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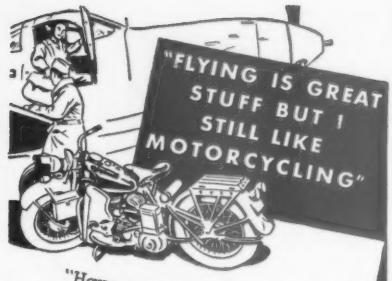

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(*Continued from page* 160)

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ADF makes possible safe navigation of the off-airway space without visual reference to the ground. By simply tuning an ADF receiver to a radio station, a sensitive pointer on a dial records the direct course to that station. ADF receivers not only determine the compass bearing for flight to a certain point, but by simple triangulation in receiving signals from additional radio stations, accurate position in relation to course may also be established. Thus, ADF provides advantages and flexibility which have not been possible with radio ranges.

Almost all of our domestic airliners are equipped with these ADF receivers and are successfully operating off-airway routes with ADF radio navigation. One airline delivers 12,000 pounds of additional war express to a certain city each day simply by flying "bee-line" with ADF. Flights of such globe-encircling services as the Air Transport Command now are based primarily on reception of ADF radio signals supplemented with celestial navigation. During the war, extensive training in ADF navigation for air service pilots and those of our extended domestic routes, has demonstrated its accuracy and popularity. One important fact is definitely established: ADF is regarded as the outstanding and preferable radio aid to air navigation.

Those favoring the continuation of our system of radio ranges and airways will point out that ADF equipment is heavier than a range receiver. It is reasonable to believe that development in ADF receivers will be accompanied by weight reduction. It is further pointed out that ADF is subject to variations and error caused by electrical disturbances in the atmosphere. But many pilots believe ADF to be more reliable than radio beams, and the dial indicators will point courses when beam signals cannot be heard.

We now are faced with two types of air navigation; first, traffic within civil airways flying with the aid of radio ranges; and second, off-airway flights using ADF navigation. Because an off-airway ADF flight might intersect the course of a flight within the airways at any point, it is difficult to devise a plan wherein both an intricate system of civil airways and unlimited use of ADF procedures can operate safely.

We can achieve freedom and efficiency of flight, simplicity of regulation, and reduction of air traffic control to the essential degree only by the elimination of our present civil airways! Such a proposal will appear to be radical and hazardous to those who have planned air traffic based on the airways system. However, complete freedom of the air space, with safe flight in any direction, and facilities for radio navigation to all points instead of a limited few, must be attained.

Flight in any direction in all weather conditions other than "clear and unlimited," requires one basic factor: flight altitude separation to prevent aerial collision. Pilots will comply very willingly with this requirement if it is practical and easily remembered.

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Altimeters record every change in atmospheric pressure. Our present method of flight altitude separation is too complex, and is required only within airways. It is predicated on each pilot *remembering* to reset his sensitive-type altimeter to the latest barometric pressure reading as he passes over or near a radio range station. One serious airline crash is known to have resulted from incorrect setting of the altimeter scale. Too many complaints have been registered to believe that this system is working satisfactorily. We, therefore, are conducting instrument flight under a sense of security which actually does not exist.

To correct this situation, why not seal one sensitive-type altimeter in each airplane to one universal and standard barometric setting? Then, no matter how barometric pressure changes, the indicated altitude would be uniform in all aircraft in the same locality. Naturally, if we had one sealed sensitive-type altimeter in each aircraft, an additional sensitive altimeter would be necessary for instrument let-down or approach to an airport. One altimeter could be marked "cruising level," and the second for "instrument approach."

A simple system known as "helical flight separation" would require certain cruising altitudes in relation to direction of flight. With this plan, flights on the same compass bearings would occur at intervals of 2,000 feet in altitude. In other words, northbound flights would be vertically separated from southbound flights by 1,000 feet, and southbound flights would have 500-foot separation from west or eastbound flights. A minimum of 250-foot separation is provided for flights converging on 45° courses.

Such a system is practical, and flight levels could easily be marked on the compass cards as a constant reminder to pilots to maintain the correct altitude. Certainly, this system would be far superior to the assignment of flight altitudes for instrument flight within the airways and no requirement at all for cruising altitudes of off-airway flights!

If the plan of helical flight separation is adopted, together with the universal and fixed setting of altimeters, it would solve the problem of flights in any direction at any time without air traffic control.

The accuracy and popularity of ADF radio equipment cannot be ignored. Many ADF non-directional radio ground stations have been installed throughout the country. These installations cost considerably less than our present radio range stations. Instead of spending additional millions for expansion of the present systems, or for the post-war program calling for high-frequency, "line-of-sight" radio range stations, there is a better and more economical way of securing ground navigational facilities.

ADF receivers can tune into any commercial broadcast station and secure the necessary course bearings. Uninterrupted broadcast from our hundreds of commercial radio stations could be insured for a fraction of the cost of planned expenditure for post-war airways based on the new-type high-frequency radio ranges. Present ADF radio stations, with the addition of hundreds of commercial stations, will provide the radio facilities needed for instrument flight to any desired point in the country.

Following this simple system each pilot would be able to determine his cruising altitude, and would adopt universal use of ADF radio navigation. This eliminates the necessity for an extensive airway traffic control system and permits flights to any point with entire freedom.

It is recognized, however, that air traffic within localized congested areas requires some means of local control, which is needed in areas adjacent to primary airfields serving a city or community. This can be accomplished through the designation of what we might call "control zones."

During the war, the Army and Navy have installed many low-powered radio ranges, or "localizers," to serve important military airfields. This indicates a definite trend toward the use of high-powered radio facilities for point-to-point navigation, and use of "localizers" for local instrument approach to airports. This ties in with the suggestion of control zones.

A control zone would be the area within a circle having a radius of 10 or 15 miles, centered on the radio localizer serving the principal airport in the vicinity. The size of these circles would be expanded or diminished in direct ratio to the volume of traffic. Control zones would extend to a height of 5,000 feet above the ground. Interference with through traffic would thus be eliminated, as such flights would either pass over the top or fly around the zone.

In order to segregate traffic within the control zones, range approach channels two miles in width would be established on each of the four radio beams of the localizer. These range approach channels would automatically divide the zone into four quadrants, each of which could be assigned for specific types of flying. Student training flights would be segregated from commercial cargo operations, and pleasure flights would be separated from military operations.

All flights approaching a control zone from any direction, and destined to land at the principal airport in the zone, would circle counter-clockwise until intersecting one of the four beams of the localizer, and then proceed into the control zone within a range approach channel. This procedure would apply for any type of weather, contact or instrument, day or night. Flight altitude separation would not be required within the channels, as the ascending or descending planes would all be guided by local control tower instructions.

In most cases, large communities are served by several airports within the immediate vicinity. Traffic to and from these fields would be easily handled by the adoption of the control zone idea. Aircraft using these satellite fields would be permitted to enter or depart from any quadrant of the zone at any time, but would be required to cross the range approach channels at less than 1,500 feet above the ground so as not to interfere with other flights within the channels.

(*Continued on page* 170)

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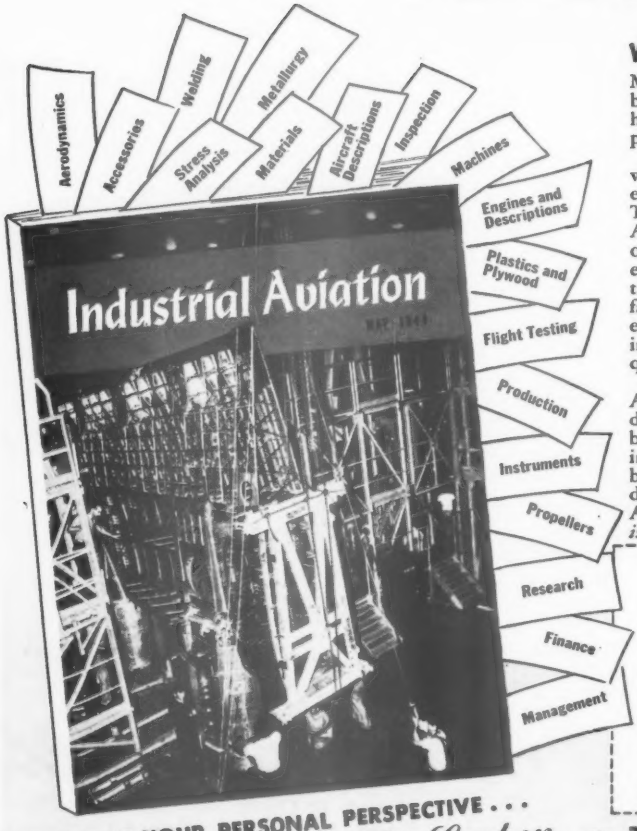

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(Continued from page 166)

This is merely an outline of the operational possibilities of control zones. For instance, it might be advisable to define control zones as a square, instead of a circle, with its corners centered on the beams of the localizer. This would provide straight-line flight on the perimeter of the zone from one range beam to another, eliminating the difficulty of trying to follow a circular course. Control zones could be improved and supplemented with several types of navigational aids. Rotating beacon lights could mark the center lines of the four range approach channels, and the perimeter of the zones could be marked for both day and night operations. In fact, the flexibility of control zones appears unlimited.

Important and secret development of radio devices during the war cannot be discussed at this time, but there is no indication that these wonders of modern science cannot be applied to airline operations within a short period after the termination of hostilities. It is quite possible that these devices will eliminate future need for the suggested control zones, and surely they will add to the simplification of air traffic control. It is certain that whatever program is adopted, we must be aware of the possibilities presented by the latest electronic developments. Our present system of airways and air traffic control will not be readily adapted to these developments, while the proposals made above can be supplemented best by their use.

In making these suggestions I have incorporated only those aids to air navigation which are being successfully used today. I would not recommend immediate abandonment of our airways, as they are avenues reserved for flight through unnumbered war-time activities. The pattern of future aviation will be determined through wide discussion and the concentrated thought of many experts. Therefore, if immediate thought can be diverted to the solution of the problems now before us, instead of to the perpetuation of our present saturated system, the safety and efficiency of aviation will be a foregone conclusion.

I have endeavored to outline a scheme of flight that is practical, safe and free from the present over-regulation that is stifling the very life and development of aviation. *First,* let us abandon the airway system and utilize ADF radio facilities to their full advantage. *Second,* let us protect aircraft from the hazard of collision by universal adoption of flight altitude separation. *Third,* let us establish control zones where required, and separate specific types of flight by simple and natural traffic rules. *Fourth,* let us reduce air traffic control to the minimum essential for flights only within the traffic control zones. END

Superfort Power Plant

(Continued from page 72)

been manufactured from raw materials in the plant, some manufacturing operations are so specialized that parts must be supplied by sub-contractors. Prominent among these, of course, are electrical fittings, generators, magnetos, motors, wiring, spark plugs. Carburetors also are made outside. In all, despite the completeness of the factory, several hundred subcontractors supply specialized equipment for the engine.

Thus far there has been no serious transportation problem, though many workers drive long distances. Two cloverleaf intersections with overhead passes were especially constructed to give better access both to the plant and the parking areas.

Even with increased personnel, however, company officials anticipate no trouble handling traffic or caring for the workers. Careful parking provisions, the tunnel system, the 14 cafeterias take care of that. The modern kitchen is on an assembly line basis no less than the machining and assembly building overhead — from its automatic doughnut-making machines to its four butchers whose only job is to cut meat all day long, and its Paul Bunyan-sized 2,000-cup capacity coffee pot.

This is the production story. Tied in with it are complete figures on every phase of Dodge Chicago's operation—except production. The engine is still so secret that even the final assembly line cannot yet be seen by outsiders.

Production statistics? Yes, from the kitchen. In a recent month it served 24,000 pounds of beef; 16,000 pounds of pork; 12,000 pounds of sausage; 5,000 pounds of lamb; 1,500 pounds of chicken; 2,500 pounds of fish. It served 500,000 eggs; 15,000 pounds of sugar; 52,000 pounds of potatoes; 92,000 doughnuts; 96,000 servings of ice cream; 196,000 pieces of pie. Some other figures are not considered military secrets, such as 200,000 quarts of milk; 474,000 cups of coffee out of that 2,000-cup pot.

Specifications? This is available for publication, too. The menu on March 31 gave a choice of five fruit juices, price seven cents; two kinds of soup; eight entrees, from spiced herring to corn fritters and lake trout, top price, 55 cents; four kinds of vegetables; choice of three salads and four salad dressings; various desserts; coffee, tea or milk; and eight kinds of sandwiches, from lettuce and tomato to ham on rye.

Consumption? Today the Dodge Chicago Plant is using each month 27 tank cars of fuel oil; 67,000,000 cubic feet of gas; 15,000,000 kilowatt hours of electricity; 15,000 tons of coal (150,000 tons are stored on the grounds); 117,000,000 gallons of water.

But for the important fact of *Superfortress* engine production, nothing so detailed can now be given. Meanwhile, one fact is sure: the big engines are going into the big bombers. You'll read about them some day soon. END

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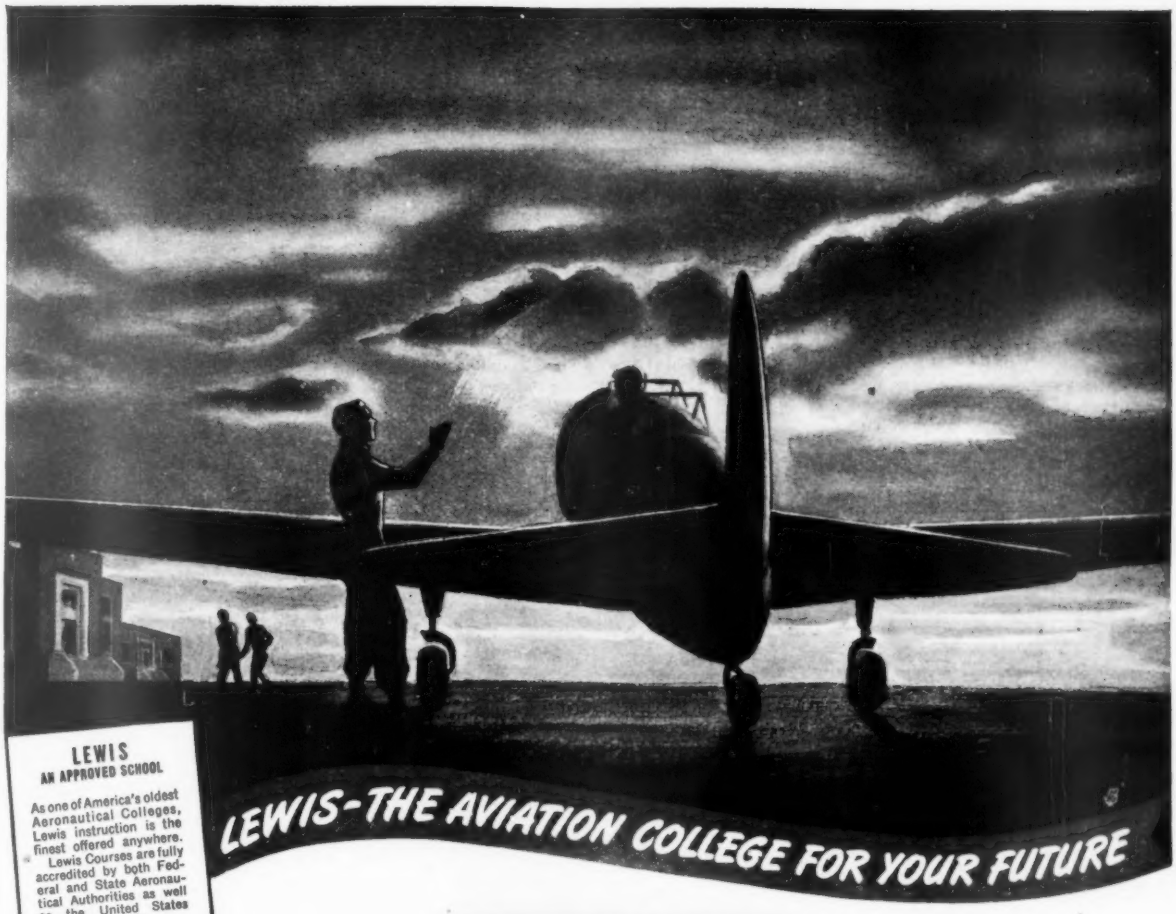

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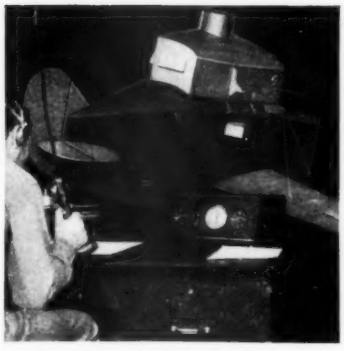

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I Learned About Flying From That . . .

(*Continued from page 78*)

into a position abeam the field heading downwind, made an S turn into the wind to lose a little more altitude, and dropped the upwing into a violent slip to kill speed. That field was awfully short and looked even smaller as we approached it. About five feet above the ground I straightened out and stalled it in. The tail wheel hit and a second later the wheels came down with a jar. The ground held us up, but we were headed into three huge trees at the end of the clearing at a fast clip. I slammed on the left brake to ground loop, hoping to keep from smashing head-on into the solid-looking cypresses and, as I did, the plane swerved to the left, the wheel dug into the not-so-solid earth and with a grinding crash, up and over we went.

Everything was deathly quiet and I realized that the rudder was holding us upside down with our heads dangling about six inches from the mud. We both unbuckled our safety belts and performed the rather difficult task of easing out from under the wreck. Luckily, neither of us was injured but the yellow trainer was a sorry sight. The fuselage was buckled just behind the rear cockpit, the engine was almost torn out and hanging by one of its support struts, and the upper wing panel no longer resembled a wing. As we stared at the heap, another plane came zooming over, and seeing our signal that we were still hale and hearty, flew off to the base to report and send a rescue party.

Sitting on the crumpled wing swatting mosquitoes, I had ample time to think over the events of that afternoon. Although it should have been done physically, I kicked myself mentally for taking the plane out a second time without knowing definitely and with proper proof what the exact trouble had been.

After the plane had been removed from the swamp, inspection of the engine showed that a previous annealing had caused small scales of copper tubing to flake off inside the fuel line. These small flakes were just enough to shut off the fuel and evidently had been loosened by the maneuvers of the plane in the spin. Certainly if it was possible to ascertain this after the crash, it would have been possible to find out after the engine had first quit on the take-off. That first mistake of not having a complete check made to determine the stoppage caused the loss of an airplane and nearly the loss of the occupants. My second mistake was that I had much more about flying to learn than I thought I already knew! END

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Limitations of the Helicopter

(Continued from page 25)

The subject of vibration—a very serious matter—has just barely been scratched. The cost of construction of the helicopter is high. Some designers are giving a great deal of thought to a "roadable" type of helicopter, to fly when you want it to, or land and go along as an automobile. This is a lot easier to do in the helicopter than in an airplane which would have the difficulty of folding large wings. But in these combination ideas, there always is the pitfall that one might end up with a poor car on one hand and a poor helicopter on the other.

Right after the war the development is more likely to go along the lines already indicated—of professional users. The helicopter requires, to operate correctly, co-ordination, knowlege of navigation, maintenance, judgment of distances and quick alertness. All of this sums up to a limitation that will not hurt its promising professional future but will definitely fail to meet, for a few years at least, the Buck Rogers picture magazine helicopter millennium.

Meanwhile, give the engineers a chance to work out the difficulties. Now, at this time, we can proudly say that America is notably in the lead in this phase of aircraft development, and we believe it is there to stay. END

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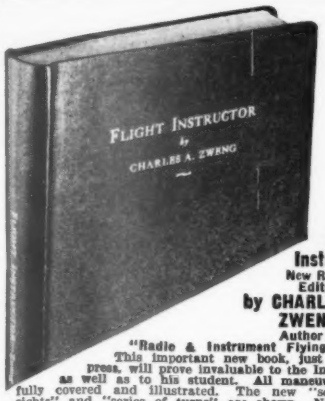

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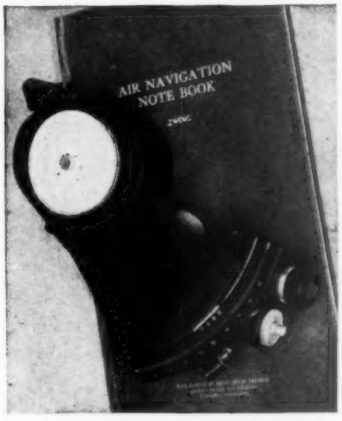

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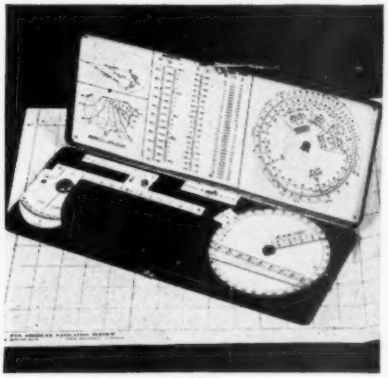

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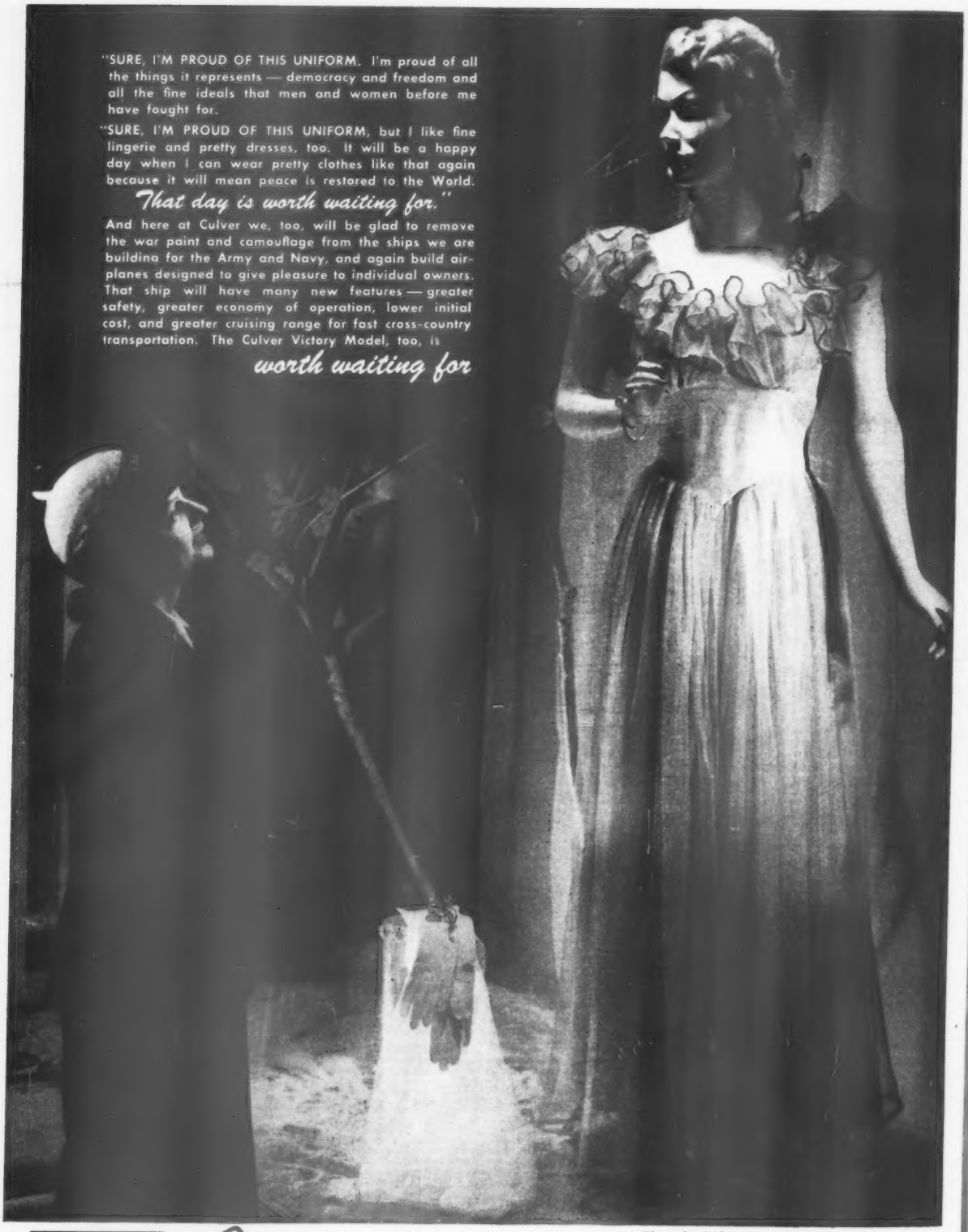
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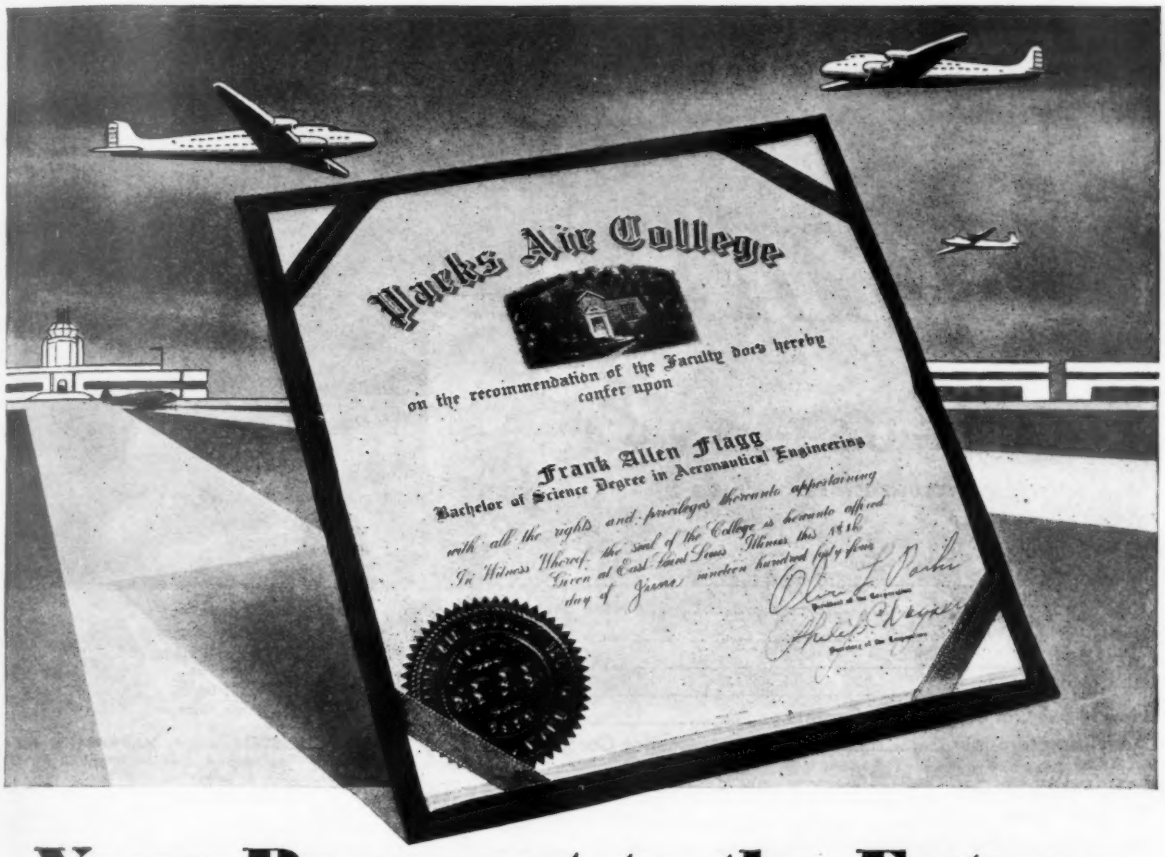
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